DEVELOPING A FRAMEWORK FOR AN UNDERGRADUATE HAEMATOLOGY CURRICULUM IN A FACULTY OF HEALTH SCIENCES

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DECLARATION

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ABSTRACT

The Faculty of Health Sciences at Stellenbosch University adopted a new set of guidelines for curriculum design in 1997, emphasising an orientation towards the requirements of the public sector general practice, a holistic approach and exposure to community lifestyle and disease patterns specific to various communities. In order to ensure the anchoring in the realities of the general practice, a family medical practitioner, appointed by the Academy of Family Practice, was included in the curriculum control structure of the faculty. It was further recommended that a family medical practitioner should be included in the curriculum committee of each discipline, where appropriate.

The present research, starting from the assumption that the opinion of a single family practitioner is insufficient to determine the adequacy of the curriculum for general medical practice, aimed to conduct a comprehensive needs analysis of all stakeholders in the undergraduate haematology training programme at the Faculty of Health, Stellenbosch University, and to compare the findings with the existing curriculum.

To this purpose, the opinions of five adult medicine haematologists, ten paediatric haematologists, four laboratory haematologists, ten interns, fourteen students and twenty general practitioners were surveyed. An open-ended questionnaire on the usefulness of the haematology module for hospital and independent general practice was analysed, using the "coding technique" method. On this basis, a list of subjects was drawn and, using a Delphi method, the participants in the study were asked to rate their importance for practice.

The answers to the open-ended questionnaires revealed a few overarching concepts, the most important being the need to structure the material taught in the form of "approaches", supporting the differential diagnosis, which is the most frequent task of a general practitioner. Among the outcomes identified in the panellists' answers, the need to adequately detect and assess the "red flag" signs for haematological cancers was proposed for consideration as an outcome in the next curriculum.

The Delphi survey indicated a group of subjects which were rated as most important for practice and another group designated as devoid of utility. The remaining subjects, rated as of moderate importance, could be further classified as diseases usually managed by the general practitioner and pathology which would be referred to a specialist for management. These

findings were compared with the existing curriculum and the discrepancies were analysed, resulting in a set of proposals towards a framework for a new undergraduate haematology curriculum.

For the first time in the literature, as far as can be determined, this research presents outcomes and content for an undergraduate haematology course which were defined and rated for importance by consensus of the curriculum developers, specialists in the field and graduates of the course. The methods tested in this process and some of the trends revealed might be useful for curriculum development in other medical disciplines.

ABSTRAK

Die Fakulteit van Gesondheidswetenskappe by die Universiteit Stellenbosch het in 1997 nuwe riglyne vir kurrikulumontwerp aanvaar. Hierdie riglyne beklemtoon `n bewustheid van die behoeftes van algemene praktyk in die openbare sektor, `n omvattende benadering tot en blootstelling aan die gemeenskapslewenstyl, asook aan siektepatrone eie aan verskillende gemeenskappe. Om te verseker dat die kurrikulum in die werklikhede van algemene praktyk geanker bly, is `n algemene praktisyn, aangestel deur die Akademie van Huisartskunde, ingesluit in die kurrikulum beheerstruktuur van die fakulteit. Dit is verder ook aanbeveel dat, waar van toepassing, `n huisarts in die kurrikulumkomitee van elke dissipline ingesluit moet word.

Hierdie navorsing, wat van die veronderstelling gespruit het dat die opinie van `n enkele huisarts onvoldoende is om die toepaslikheid van `n kurrikulum vir algemene praktyk te verseker, het ten doel gestel om `n omvattende analise van behoeftes van alle belanghebbendes in die voorgraadse hematologie-opleidingsprogram by die Fakulteit van Gesondheidswetenskappe, Universiteit van Stellenbosch, te doen en om die bevindings met die bestaande kurrikulum te vergelyk.

Die menings van vyf volwasse medisyne hematoloë, tien pediatriese hematoloë, vier laboratorium hematoloë, tien huisdokters, veertien studente en twintig algemene praktisyns is verkry. `n Oop-einde vraelys oor die bruikbaarheid van die hematologie-module vir hospitaal- en onafhanklike algemene praktyk is m.b.v die gekodeerde tegniek ontleed. Op grond hiervan is `n lys onderwerpe gekies en studiedeelnemers is deur van die Delphi-metode gebruik te maak, gevra om die graad van belangrikheid van elkeen aan te dui.

Die antwoorde op die oop-einde vraelys het `n paar oorkoepelende konsepte uitgelig. Die belangrikste hiervan was om die materiaal wat gedoseer word te struktureer in die vorm van ‘benaderings’, wat die vorming van `n differensiële diagnose ondersteun. Lg. is die algemeenste taak van die algemene praktisyn. Een van die uitkomste wat deur die studiedeelnemers geïdentifiseer is, nl. die vermoë om die `rooi vlag` tekens van hematologiese kankers korrek te bespeur en te assesseer, is voorgestel vir oorweging vir insluiting as `n uitkoms in die volgende kurrikulum.

Die Delphi-vraelys het `n groep onderwerpe aangedui wat gegradeer is as `die belangrikste` vir praktyk en `n ander groep wat as `onbenullig' aangedui is. Die oorblywende onderwerpe, wat aangedui is as van `matige belang`, kan verder geklassifiseer word as siektes wat gewoonlik deur die algemene praktisyn hanteer word en patologie wat na `n spesialis verwys word . Hierdie bevindinge is met die bestaande kurrikulum vergelyk en die teenstrydighede is ontleed, waarna voorstelle vir `n raamwerk van die nuwe voorgraadse hematologie kurrikulum gemaak is.

Vir sover bekend die eerste maal in die literatuur, dui hierdie navorsing uitkomste en inhoud vir `n voorgraadse hematologie-kursus aan. Hierdie uitkomste en inhoud is bepaal en gegradeer t.o.v belangrikheid en eenstemmigheid is bereik tussen die ontwikkelaars van die kurrikulum, graduandi van die kursus en vakkundiges. Die metodes wat tydens hierdie proses getoets is, asook die neigings wat na vore gekom het, mag moontlik van waarde wees vir die ontwikkeling van kurrikulums in ander mediese dissiplines.

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DEDICATION

This thesis is dedicated to my husband, Valentin, and my daughters, Dora and Sabina, who mean everything to me.

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ORIENTATION TO THE STUDY

One who asks a question is a fool for five minutes; one who does not ask a question remains a fool forever. Chinese proverb

1.1 Introduction and background to the study

The idea of conducting research on curriculum development occurred to me after analysing student feedback on the haematology course for the first time, in my capacity as newly appointed chairperson of the haematology module at the Faculty of Health Sciences, University of Stellenbosch. The students had to fill in a standard feedback form, on which a number of items considered to be important for the evaluation of the course were given a rating from 1 to 10. The second part of the form contained free and anonymous suggestions, together with criticism or appreciation, and all this revealed numerous important aspects, completely unknown to me until then: the computerised testing was designed in a way that made it difficult to read; the block was split in two by a practical period in another discipline and the students had lost their focus on haematology when returning; some presentations were too dry and unattractive; some students had difficulty in following the English presentation and were requesting that writing on the slides should be in Afrikaans; some lecturers were praised while others were harshly criticised; there were too many data concerned with pathophysiology and histology in the lectures and too little emphasis on practical aspects.

I wondered why many of the issues had not been addressed during the planning and preparation of the course. How was the curriculum developed, in fact? Who was drawing it up and on what basis, following which guidelines? Were the students involved in the planning? I went on to find out what the curriculum guidelines of the Faculty were. I then discovered that the haematology training was designed by specialists in the field, with the

assistance of a general practitioner, in order to ensure the relevance of the studies for generalist practice. There was no student involvement, indeed. Moreover, how informed, how representative, how objective and how strong was the voice of the single general practitioner included in the haematology curriculum committee?

The literature was reporting the experience of other faculties in structuring their curricula after a comprehensive needs analysis, involving not only the lecturers, but also the learners, the graduates who were already working, their employers and the communities where the new doctors were practising. How difficult might it be to perform such an analysis in the case of the specialty of haematology? How could the rainbow of suggestions to be expected from such a comprehensive survey be structured in order to extract meaningful information for curriculum development?

The Delphi method, a mailed survey consisting of the repetitive consultation of a panel of experts, with structured feedback after each step, held the promise of extracting consensus from the answers. It had been used already for opinion surveys on military, economic, social and political issues, for several decades. The method had been applied in determining the needs for curricula design, but not yet for a haematology undergraduate course of a faculty of health sciences.

I was now in possession of all the elements required to initiate my research on the haematology curriculum design at the Faculty of Health Sciences, University of Stellenbosch: the curiosity, the method and the determination to accomplish it. In order to gain the necessary background information, I proceeded to investigate the fundamentals of curriculum design within the larger context of education and especially higher education, focusing afterwards on the theory of medical curriculum design and specifically on the undergraduate curriculum in haematology.

The contemporary meaning of the notion of curriculum is that of all planned learning experiences presented by an educational institution. At least four elements are encountered in the majority of curricula: content, teaching and learning strategies, assessment of students' knowledge and feed-back processes on the validity of the curriculum (Prideaux 2003).

Ideally, the approach to curriculum development should be evidence-based, but the paucity of research in this field does not offer enough reliable data (Sanson-Fisher & Rolfe 2000) and thus it is still determined by opinion-based processes. A number of traditions can be

demarcated in the field of curriculum design (Neary 2002). The *liberal-humanist tradition* places its emphasis on knowledge transmission without sufficient regard to the relevance of the information to real life. The *progressive tradition*, to counterbalance the excessive role of the teacher in the liberal-humanist approach, puts the learner in the centre of the educational process and strives to help learning through discovery. The result is enhanced creativity, confidence and learning to work in groups; the system was criticised, however, as opening the way to lack of structure and discipline.

The *technocratic tradition* starts from defining the desired outcomes – what should learners be able to do – and works backwards from there to establish how to achieve them. Its limitation is that valuable ideas arising spontaneously in the teaching process sometimes may not be exploited because they are not on the outcomes list. It does not, therefore, leave enough room for building broader understanding of the field studied. Finally, the *cultural-analysis tradition* sees the education institution mainly as the transmitter of culture elements from one generation to another: the curriculum is the result of a negotiation between generations. As in every negotiation, there are positions of power or powerlessness which influence the result.

Curricula in medical studies draw mainly on the technocratic tradition; however, in order to stimulate students' interest in their studies, numerous schools of medicine worldwide have introduced the method of problem-based learning, which essentially consists of learning through discovery and thus falls under the umbrella of the progressive tradition.

Historically, medical education consisted of the study of medical texts complemented by apprenticeship in the practice of an established doctor. The works of Hippocrates and Galen constituted the core of medical theory until the 18th century in the western world, when they gradually made room for new data provided by the progress of science and by the direct observation of patients and reflection on the findings (Warren 1951). The landmark recommendations by Flexner for the reform of medical education in the United States, in 1910, definitively established that medical schools should be part of universities; that the basic sciences should be taught before clinical theory; and that the teaching hospitals should be affiliated to medical faculties. These principles are universally applied nowadays.

The designing of medical curricula needed to evolve, especially in the second half of the last century, in order to produce a doctor who could deliver better healthcare in the context of the rapid progress of knowledge and of increasing expectations among the patients and, last but

not least, to satisfy the requirements of various regulatory bodies. The answer to such pressures was formulated by the group at the Johns Hopkins Faculty Development Program for Clinician-Educators, in a systematic approach to curriculum development (Kern 1998) which, during the last four decades, has been adopted by numerous other faculties of medicine worldwide (Amin 2003:60). Their approach consists of six steps: problem identification and general needs assessment; evaluation of the needs of targeted learners; establishing goals and objectives; determining educational strategies; implementation; and evaluation and feedback.

The general needs assessment step requires a comprehensive consultation of the practitioners, patients, medical education system representatives and society at large on the current approach that they have to the particular health problem addressed by the curriculum and also on the ideal approach to that problem. The difference between the current approach and the ideal one represents the needs which should be fulfilled by the educational process (whereas the knowledge, attitudes and skills required for the current approach are already covered by the programme). The assessment of the needs of targeted learners, which are specific to those currently in the process of education, also requires a consultation with that group. On this basis, goals and objectives are formulated, content, teaching methods and assessment tests are selected, and resources are allocated. The programme has to include evaluation and feedback modalities.

The Delphi method for expert opinion gathering, briefly described above, although not the only instrument that can be used to accomplish these consultations, represents a valuable tool as it allows for extracting consensus from the answers of those surveyed.

My subsequent steps were to review research aimed at undergraduate haematology curricula design and then to familiarise myself with the context and the method used to draw up the undergraduate haematology curriculum at the Stellenbosch Faculty of Health Sciences. I found that the research published on curricula in haematology for undergraduate students is minimal. The most consistent study is a survey of the undergraduate haematology programmes in universities across the United States, published in 2007 (Broudy). Other publications mainly recorded personal opinions, dispersed over the last four to five decades. By contrast, the attention given to postgraduate specialisation curricula in haematology is substantial: model curricula were published by the American Society of Hematology and the European Hematology Association.

The Faculty of Health Sciences at Stellenbosch University adopted a new set of guidelines for curriculum design in 1997. They were meant for adapting the training of the future medical practitioner to the needs of the whole South African community, emphasising an orientation towards the requirements of a public sector general practice, a holistic approach and exposure to community lifestyle and disease patterns specific to various communities. In terms of teaching and learning methods, a move away from the lecturing approach was recommended, with more time spent in self-study activities. In order to ensure the anchoring in the realities of generalist practice, a family practitioner appointed by the Academy of Family Practice was included in the curriculum control structure of the faculty. It was recommended that a family practitioner should be included in the teams who designed training modules, where appropriate. A profile of the Stellenbosch graduate was drawn up; this comprised a list of overarching knowledge attributes, skills and attitudes to be obtained by the students (Stellenbosch University 1997).

The task of establishing the content of the modules, the teaching and learning methods, as well as the assessment modalities was then delegated to the various disciplines where it was accomplished by the specialist teachers. The undergraduate module in haematology was designed along these Faculty guidelines. While this is a comprehensive teaching plan, drawn up by experienced academics in collaboration with a general practitioner, scrutiny of it raised several questions, which I will outline below.

1.2 The research problem

At the beginning of this chapter I mentioned the criticism levelled at the contents and process of the haematology curriculum by the students in their anonymous feedback. That was the inspiration for this research. I asked myself: If the programme did not fulfill the needs of the learners, can it safely be assumed that it transmitted the knowledge and skills required by the future practitioners?

In performing its task, the design committee relied on previous curricula from Stellenbosch and other institutions, on the guidelines handed down by the Faculty; on the requirements for accreditation with the National Commission for Higher Education and the Health Professions Council; on the published literature on haematology programmes for undergraduates; and on their own experience.

However, literature on the theme is remarkably scarce and does not apply entirely to the South African context. There is, in fact, no study covering the needs of the general practitioners who manage haematology cases, in this country or abroad. The Faculty guidelines, as well as the national guidelines from South African institutions accrediting tertiary education programmes contain only principles and do not offer model curricula. The specialist training curricula in haematology developed by some overseas institutions would not be suitable for use in undergraduate programmes, as they are too complex. In the absence of substantial information on the needs of the generalists, could the haematology programme still offer the basis for efficient medical practice?

Aside from the above, I asked myself what the effect of the usual patterns of dominance and "follow the leader" behaviours may have been on the outcome of the group sessions required to define the programme. Could the final product perhaps just be a reflection of the opinions of the more assertive and vocal member(s) of the committee, while the relevant experience of other members was rejected.

In situations where the available information on the general needs related to the health problem addressed by the curriculum does not allow reasonable conclusions, the Johns Hopkins group recommends that new information should be obtained from the "stakeholders", as outlined above in 1.1. Yet, in the process of drawing up the curriculum in undergraduate haematology at Stellenbosch, no comprehensive consultation was incorporated, either with specialists or with general practitioners.

I thus identified an opportunity to carry out a broad consultation with haematologists, general practitioners, students and interns, in order to determine their opinions on the knowledge and skills required for managing haematology cases in general practice. The findings would be compared with the existing haematology curriculum for undergraduates at the Stellenbosch Faculty of Health and the significance of the differences uncovered would be evaluated. Not only could the results of this consultation serve to improve the existing undergraduate haematology module at Stellenbosch, but the process followed could be used as guidance for similar consultations when establishing curricula in other disciplines.

1.3 Research questions

From the considerations described above, it ensued that the central question of this research was: ***What changes should be made to the existing undergraduate curriculum in haematology at The Faculty of Health Sciences, University of Stellenbosch, in order to make it relevant to the needs of general practitioners?***

In order to answer this central question, the research had to provide answers to the following:

- What elements of knowledge and skills are required for efficiently managing haematology patients in general practice?

- What is the hierarchy of importance of the above elements for the generalist practice? The term "importance" is used here to designate the frequency with which the element of knowledge or the skill is used as well as the impact it makes on the outcome for the patient. For instance, blood transfusion is a rare therapeutic skill but may be life-saving, thus important. Also important is the interpretation of a full blood count result, which is not as dramatically life-saving but is a frequently used skill.

An additional question addresses ***the value (advantages and limitations) of the Delphi method in surveying the stakeholders in the curriculum*** for their opinions on the two issues formulated above.

1.4 Aims and objectives of the study

This research aimed to delineate a framework for a new undergraduate haematology curriculum at The Faculty of Health Sciences, University of Stellenbosch, based on the results of a needs analysis undertaken with the use of the Delphi method.

The study had the following objectives:

- To explore the historical evolution of the philosophy and design of the curriculum in general up to the present time, with emphasis on higher education and especially on medical education, and identify the ways in which the relevance of curricula for the actual professional practice was ensured.

- To determine the knowledge and skills required in managing haematology cases in adult and paediatric hospital practice, as well as in general practice settings in the Western Cape.

- To prioritise theoretical subjects and skills as determined by various groups of faculty members, specialist haematologists, learners and graduates, i.e. interns and general practitioners.

- To draw up a list of theoretical subjects and skills rated by the panel according to their relative importance and to compare it with the existing curriculum. On this basis, to identify changes to the present curriculum in haematology that would bring it in line with the requirements of primary care practice.

1.5 Research methodology

To investigate the relevance of the haematology module for generalist practice, I organised a consultation with several groups of stakeholders in the undergraduate haematology curriculum at the Faculty of Health Sciences, University of Stellenbosch. Their involvement with the programme, either as teachers or as learners (present or past), and their experience in patient care situated them in a position of "experts" in how the knowledge received during the haematology module applied to practice. In order to achieve a valid triangulation, the following panels of professionals and students were invited to participate: 20 general practitioners, 5 adult haematologists, 10 paediatric haematologists, 4 laboratory haematologists, 10 interns and 14 sixth-year students. I chose not to include patients, although Kern et al. (1998:14) mentions surveying patients in their needs analysis methods. The patient, however, is an "expert" only in her or his disease and such narrow input would not have served the aims of the study. In the absence of clear guidelines from the literature, the size of the panels remained to be dictated by the availability of participants in a given group and by the available time and resources.

After obtaining their informed consent to participation, the panellists' expertise was interrogated in two ways: in the first phase, using open-ended questionnaires, I asked for their opinions on the quality of the course and its usefulness for practice. They were also invited to make proposals of subjects for inclusion or exclusion from the curriculum, based on their

experience in daily patient care. These questionnaires provided a large amount of raw data, which I analysed using the "coding" technique.

In the second phase, a list of topics was drawn from the received suggestions, combined with the subjects already existing in the haematology curriculum, and the participants were again surveyed on the importance of each topic for the practice of haematology. This survey was done using a Delphi method with three iterations. The panellists were invited to rate the value of each topic for their practice, using a Likert scale with four grades: not important, of little importance, of moderate importance and essential.

The Delphi method was chosen for its advantage of fostering consensus among those surveyed. After the first round, consensus was attained on some of the ratings. For those topics where there was no agreement, percentages were calculated for the four ratings of every item. A second round of questionnaires was then sent, revealing these percentages and the participants were invited to reconsider their opinion in the light of the anonymous statistical feedback received. After this second round, consensus was attained for the ratings of a further number of topics. The process was repeated once more. The significance of the results was then analysed.

A number of subjects were designated by the participants, in consensus, as very important for practice. Other subjects were judged as of very little interest, while the remaining majority was rated as either of modest or moderate importance for a general practitioner's activity. All findings were compared with the existing curriculum and the significance of the differences found was discussed. Finally, backed by findings from both open-ended questionnaires and the analysis of Delphi results, I made a number of proposals for a new undergraduate curriculum framework in haematology.

1.6 Locating the study

This study essentially comprised research on the process of designing an undergraduate haematology curriculum starting from a comprehensive consultation of stakeholders. It is therefore positioned in the field of Health Sciences Education. Nonetheless, researchers from other medical or non-medical education fields may find valuable data gleaned from the history and the actual state of curriculum theory. In addition, the process used to collect and

analyse the data from the broad consultation may serve as guidance for curriculum design in other educational domains.

I decided to focus on undergraduate haematology training because of the paucity of studies addressing this particular curriculum. The preoccupation with quality specialist education in haematology is much more evident worldwide, and involves not only faculty teachers but also professional associations of haematologists, as mentioned in 1.1. Model curricula for specialist training have been carefully drawn up already to ensure practitioner competence, even across borders. However, the impact of appropriate training at generalist level is, in my view, more significant for the health of the public. The general practitioner provides the first contact of the patient with the health care system and the quality of her or his diagnosis and management substantially influences the outcome in haematological diseases.

Although my scrutiny of the literature extended to the domain of general – and medical – curriculum theory, it was not my intention to extract new theoretical additions to the subject from this research. I only aimed to explore the process of consultation as a basis for designing a health care curriculum and to formulate observations that may be applicable to other disciplines, located in medical or non-medical domains. The theme chosen is small enough to allow for a detailed analysis and at the same time sufficiently substantial to support valid conclusions for the education process.

1.7 Limitations of the study

Kern et al. (1999:16) suggest ten methods which could be used to collect information from the stakeholders in the curriculum (see 2.5, Table 2.2, page 43). The Delphi method is only one of these, along with focus groups, nominal group technique, direct observation of doctor activities and others. These modalities of performing a needs assessment are complementary and, should they be used in combination, would undoubtedly generate a more realistic and comprehensive picture. Then again, they are time-consuming and resource-intensive by comparison with Delphi.

The main disadvantage of the Delphi method is that the panellist is offered a menu or a list of items from which she or he has to choose, or which need to be prioritised or rated. Should the participant want to propose an item which does not appear in the menu, she or he is invited to formulate it in writing at the end of the questionnaire, but there is no way of ensuring that it

will indeed be included and this may result in loss of potentially valuable information. In my study, this disadvantage was counterbalanced by the use of open-ended questionnaires at the beginning of the survey, by which the participants could express their opinions in a more unrestrained way. However, in such self-administered questionnaires, certain lines of thought may not be followed exhaustively and, again, valuable information may be lost. Other techniques, such as focus group discussion or in-depth interviews may be required in order to explore fully the participants' opinions. I decided not to use such methods because their intensive nature limits the number of experts and thus reduces the possibility of validating their personal opinions by corroborating with other panellists' views.

1.8 Planning / chapter layout of the study

In Chapter 2, the study presents an overview of the historical evolution of the curriculum, in general and in medicine, as well as of the evolution of ideas around curriculum design. More detailed attention is given to the modern flux of ideas relative to curriculum planning, and to developments shaping the future of the medical curriculum. Following this, the haematology curriculum is brought under scrutiny. The analysis concludes with a conceptual framework for planning an educational programme. Chapter 3 details the methodology used, with a critical overview of the Delphi method and its use in medical curricula design. The results of the research are presented in Chapter 4, with separate attention given to the findings from the open-ended questionnaires and to the results of the Delphi survey. A discussion of the significance of these results, encompassing a comparison between the research findings and the existing haematology curriculum, is presented in Chapter 5. The conclusions are formulated in Chapter 6. A list of references and an addendum containing the letters, forms and questionnaires used for the research conclude the presentation of this study.

The following chapter takes a look at the curriculum from a historical perspective, with the intention of discerning the perennial from the ephemeral and thus isolating the underlying determinants of education.

Chapter 2

LITERATURE REVIEW

Everything important is already known, the only thing is to rediscover it. Anon

2.1 Introduction

The contents of this chapter go beyond a simple review of what has been published to date on the theme of needs analysis in the construction of curricula. Indeed, this concept is already half a century old and has been developed to its last consequence and criticised, probably, to the last argument that could be produced. Its exhaustive research would have equipped me with the necessary expertise in the ways of doing it. Since I decided, in fact, to limit my experiment to the use of the Delphi method, I could have narrowed my search further, to cover only the ways of using Delphi in developing curricula. However, once I performed the needs analysis, I would have had a multitude of data to deal with and I felt that I lacked the perspective required to assess the significance of my findings. I decided therefore to read much more broadly on education and medical education, using a historical perspective, in order to discern the fundamental principles governing education and curriculum construction, including medical education and curricula.

2.2 "Curriculum" as a concept

The origin of the word "curriculum" is Latin, in which it means "a running, race, lap around the track, course" (Glare 2000). Its contemporary meaning is that of "courses offered by an educational institution or a set of courses constituting an area of specialization" (Merriam – Webster's Dictionary 2009). A definition has to be concise and therefore might not always refer to all aspects of a concept. Several authors and theorists on the topic of curriculum have proposed definitions. Tyler (1949:3), for instance, described a curriculum as "All of the learning of students which is planned by and directed by the school to attain its educational goals". Along the same line, Wheeler (1967:15) proposed that by "'curriculum' we mean the planned experiences offered to the learner under the guidance of the school". In a schooling

context, Skilbeck (1984:21) sees the curriculum as "...the learning experiences of the students, insofar as they are expressed or anticipated in goals and objectives, plans and designs for learning and the implementation of these plans and designs".

A more comprehensive definition was formulated by Glatthorn (1987:3): "The curriculum is the plans made for guiding learning in schools, usually represented in retrievable documents of several levels of generality, and the actualization of the plan in the classroom as experienced by the learners and as recorded by an observer; those experiences take place in a learning environment which also influences what is learned." Here the author distinguishes three constituents of the curriculum. In the first place he mentions the planning meant to guide the learning, which results in a number of documents. The documents describe the outcomes desired by the course, the objectives derived from those outcomes, the content (i.e. the syllabus), the teaching strategies, the student evaluation strategies and the modalities of obtaining feedback on the curriculum. The result of this planning process is an intellectual product on paper. It could be proposed and enforced as a policy; it could even be sold as a blueprint for organising a similar course in another learning institution. Students do not appear in this plan: the focus is on teaching.

The second constituent is the actualisation of the plan in the training process and the perception of learning material by the learners. The need to allude to this in the definition arises from the fact that the actual teaching is conditioned by various elements: the availability of teachers, their teaching skills, access to lecture rooms and to audiovisual technology and so on. The interaction with the learners may facilitate or impede the whole process (for instance, students do not attend lectures or disrupt them). Further, the message perceived by the students may not be exactly what was intended by the teacher, neither may their behavioural change correspond, at the end of the course, to what the written curriculum prescribes. The curriculum enacted during the actual training may therefore acquire different characteristics from the one that was intended. It will be defined through a process of interaction between teacher and students.

In the third place, the "learning environment also influences what is learned". Indeed, when adopting a broader perspective on the teaching process, it is interesting and significant to observe that the students may also learn something else than the planned content of a curriculum.

Such unintended side effects, originating in "the learning environment", are a component of the educational experience too, and constitute the "hidden curriculum" that was not planned but nevertheless was transmitted by the teachers to their learners together with the intended content. Thus, a school may encourage a "Spartan attitude by keeping the school dormitories cold or a sense of beauty by placing the school in glorious mountain scenery. Here it would be linguistically absurd to say that cold dormitories and mountains were in the curriculum" (Wilson in Neary 2002:34), nevertheless, they would shape, to a certain extent, the personalities of the students.

An educational institution cannot be artificially separated from its historical, geographical, economic, social and cultural context. Education is, at all its levels, "the influence exercised by adult generations on those that are not ready for social life. Its object is to arouse and develop (in the child, in this case) a certain number of physical, intellectual and moral states which are demanded of him by both political society as a whole and the social milieu for which he is specifically destined" (Durkheim in Pickering 2005:107). In this process, learners learn many values and forms that teachers are not consciously trying to teach them. While Durkheim rated this process as a positive one, the hidden curriculum was seen, by mainly Marxist critics, as a process which contributes to perpetuate social inequalities. In fact, it is conceivable that numerous other negative sides of social interaction might be perpetuated in this manner: bigotry, misogyny, prejudice, racism, class structure and political or philosophical ideas that suit the existing social structure. "The functions of the hidden curriculum have been variously identified as the inculcation of values, political socialization, training in obedience and docility, the perpetuation of the class structure – functions that may be characterized as social control" (Eisner in Neary 2002:46).

The hidden curriculum is "pervasive and powerful" (Barnett 2005:39) and therefore may raise legitimate concerns; a modality of counteracting it would be to tackle its ideology in the open curriculum. On the other hand, the open curriculum may be, and indeed was, used for propaganda and indoctrination, the best examples in history being offered by Nazi Germany, the Stalinist Union of Soviet Socialist Republics and Maoist China (Print 1993:16).

While the nature of the hidden curriculum is a phenomenon that requires attention in any learning institution, this study will deliberately concern itself only with the planned learning experiences in the medical school.

2.3 A brief history of curriculum development theory

2.3.1 Ways of studying curricula

The multitude of present-day currents of ideas in the field of curriculum development may be disconcerting. Attempts to discern between opinions, arguments and contra-arguments require an effort of classification, an endeavour to identify prevailing themes and to delimit schools of thought. An alternative is to approach the analysis from a historical perspective as this presents a number of advantages. It allows, first and foremost, the possibility to identify those forces that have always shaped the process of education and are still at work today. Such factors need to constitute the foundation of all theories concerning the curriculum. Second, the wheel need not be reinvented: knowledge of the ideas launched in the past puts the output of present thinkers in perspective and may confer a different colour to their theories. Third, discerning the course of history may suggest the course of the future.

Mills (1977:161-162) similarly identifies a fundamental role of history in social science research. According to him "the production of historians may be thought of as a great file indispensable to all social science" and "every well considered social study requires historical scope and a full use of historical materials".

The history of curriculum theory is tightly interconnected with the history of education in general. Education, in turn, is a reflection of the evolution of human knowledge, economy and society. Both facts and concepts pertaining to curriculum thinking shall be reviewed here: the information that we have on older societies consists mainly of facts while, in more recent times, information on educational concepts is more readily available.

2.3.2 Prehistoric and ancient times

Education, in its most comprehensive meaning – that of a process by which the young generations are being prepared to integrate themselves in society and fulfil adult roles – is as old as mankind. As the knowledge accumulated by humans increased, education became steadily more complex in its content and teaching methods. Prehistoric human groups transmitted their knowledge through oral tradition. Memorisation was the only way to perpetuate primitive culture in the absence of writing. Using rhyme and alliteration to facilitate committing them to memory, numerous songs, rituals, poems and traditions were

passed on from one generation to the following one. The young ones learnt from parents and other adult group members, by observation and imitation at first; around the age of puberty, they were given somewhat more structured knowledge, mainly religious in nature, by a designated member of the group, in the form of an initiation or another ritual (Woody 1949:20).

Around 10 000 years BCE, the practice of agriculture enabled primitive groups to settle down in villages. Occupational specialisation was possible, with the appearance of priests, artisans, traders, builders and other occupations. These skills were transmitted through apprenticeship. Social classes emerged, as well as more complex political and administrative structures.

Teaching must have evolved into a profession around 3 000 years BCE, with the advent of writing. The first notation systems were extremely complex, each sign representing a word or a syllable. The learning of writing required sustained study under the guidance of a teacher scribe; this was only affordable to the rich and therefore illiteracy remained the norm for millennia to come. Even under these circumstances, the cultural heritage of ancient civilizations, such as the Mesopotamian or Egyptian ones, was transposed in writing and large libraries were established. The best known example is the Nineveh library in ancient Babylonia. A second reason for the coming into existence of teachers was the amount of knowledge accumulated by the society. Apart from religion, subjects such as mathematics, medicine, literature (such as the Mesopotamian epic of Gilgamesh), astronomy, philosophy and military knowledge were taught, initially in temples but later in dedicated schools (Graves 2005:48).

In ancient India, the teachers (guru) were using their private residences or rooms within monasteries, to teach the Vedic texts, which contained precepts on all the subjects mentioned above (Woody 1949:162). In ancient China, a vast array of classical texts related to Confucianism, Taoism, Mohism, Legalism, Military Science and the History of China, were taught to those who wanted to enter the civil service. “The content of the educational process was designed not to engender functionally specific skills but rather to produce morally enlightened and cultivated generalists" (Foster 1996:30). The State organised examinations for these candidates, as a means of selecting the most capable for administrative posts (ibidem).

In ancient Greece, education mostly comprised reading, writing, arithmetic and music up to the age of 12. After this, most of the girls would not receive further education; boys whose parents could afford to pay were taught sciences and arts, together with physical education. At the age of 18, boys would commence military training for two years. Afterwards, those inclined towards intellectual pursuits could attend the Platonic Academy or Aristotle's Lyceum. The Academy is considered the first institution of higher education in the western world (Academy 2008). While these institutions did not have a written curriculum, subjects were studied from domains such as mathematics, philosophy or astronomy, using the Socratic Method. Socrates, the founder of western philosophy and Plato's teacher, proposed a method of study consisting of asking questions meant to challenge the students to assess their underlying beliefs and the extent of their knowledge on the matter in discussion. Hypotheses found to lead to contradictions were eliminated and better hypotheses were constructed until the truth was circumscribed (Neary 2002:68). The essence of the Socratic approach to reality can be summarised in this phrase attributed to Socrates: "I know nothing except the fact of my ignorance" (Laertius 2006 bk. 2, sect. 32). The Greeks vastly developed the sciences and the arts and their contribution persists in the curricula of secondary and higher learning to this day.

The ancient Romans developed a schooling system that is comparable to modern education, in which the student would progress from primary to middle to higher school and then to college. The progression was based mainly on intellectual performance, not on age, and the Romans considered the "gift" for learning of the student as an important quality. The Roman contribution to science, however, is minor in comparison with that of the Greeks, and most of the knowledge taught in higher learning was derived from the culture of the latter (Arnove 2008:34).

2.3.3 The Middle Ages

The Middle Ages saw a flourishing of Arab and Islamic education. Centres of excellence appeared, such as the Academy of Gundishapur and The House of Wisdom in Baghdad, where the subjects taught were drawn simultaneously from Greek, Persian and Indian cultures (Modelsky 2003:60). With the advent of Islam, most of the teaching in the Middle East and Africa took place in mosques and later in separate schools, known as madrasahs. These schools sometimes attained a very high status, like the Al Karaouine University in Fez,

Morocco, founded in 859 EC, known as the oldest degree-granting university (Guinness: 242). The origins of the doctorate can be traced back to the system used for the final examination after the lengthy (14 years) legal studies: an oral examination in the form of a disputation set up for the purpose, where the candidate's theses were tested for originality and his ability to defend them against open objections was evaluated. The Arabs created Algebra and contributed to the progress of medical knowledge.

In China and India, the traditional education continued through the Middle Ages and, in fact, ended only after the English colonisation of India, and in 1911 in China. At the onset of the British occupation of India, traditional schools existed in almost every village. However, due to the Muslim occupation, these schools dedicated a section of their curriculum to the study of the Qur'an and Muslim traditions. Subjects like literacy, arithmetic, law and ethics, medicine and religion were also taught. India had a number of universities where curricula comprised art, architecture, philosophy and logic, painting and literature, economics and politics, law and medicine (Jaffar 1973). The Chinese classics, as outlined above, continued to be the basis of studies in China (Davis 2005:123).

The European Middle Ages commenced with the gradual dissolution of all Roman culture, and thus of the Roman school system, due to the barbarian invasions. Schools persisted in monasteries and cathedrals, where grammar, rhetoric and The Bible were taught. Strict discipline prevailed, together with the attitude that the student must be a passive recipient of teaching. The monks Columban and Bede noted: "A child does not remain angry; he is not spiteful, does not contradict the professors but receives in confidence what is taught him" (Education 2008:53). A revival of the school system started with the "Carolingian Renaissance" and later continued with "The 12th Century Renaissance". Grammar schools appeared, teaching literacy, religion, Latin and arithmetic. More advanced studies concerned "the liberal arts": "The Trivium" consisted of grammar, rhetoric and logic, while "The Quadrivium" comprised geometry, arithmetic, music and astronomy (Cordasco 1976:25). The children of the nobility, however, were taught at the castles of higher ranking feudal lords, going through the stages of page, squire and knight and preparing themselves to serve as vassals and to be masters and administrators of the estates. The girls did not receive formal education: it was only in the 16th century that the order of the Ursulines, a female teaching convent, opened their schools for girls.

The first university known in Europe was founded in 1088 in Bologna. The University of Paris dates from 1150. These universities attained an exceptionally high reputation, their graduates being accepted to teach everywhere in Europe. Other universities appeared in time, and their authority to confer degrees was granted by papal bulla or royal decrees, thus marking the increasing role of the lay or religious authorities – in fact the role of the state – in education. Local schools too, needed a license to teach, which was granted by the higher ranking feudal lord or the archbishop. Their teachers were granted a license to practise only after passing an examination (Cordasco 1976:33).

2.3.4 The Renaissance and Reformation

The Renaissance in Europe marked a return to the values of Greek and Roman antiquity and the rebirth of a humanistic (as opposed to religious) approach to philosophy and science. Printing with movable type was invented by Gutenberg around 1440 and this contributed to increasing dissemination of knowledge and culture. It is in this epoch that the first notable treatise dedicated solely to pedagogy was written, by Pier Paolo Vergerio, at the turn of the 14th century (Kleinhanz 2004:822). Vergerio did not propose major changes in the content of studies; he emphasised, however, the need to expose the students to as numerous domains as possible before they went on to specialise in a field. He conceived learning not solely as a study of books, but envisaged group discussions as a valuable method of acquiring and retaining information. He also recognised the need to combine the training of the mind with that of the body, in true Greek classical tradition.

A renewal of higher education, to reflect the return to humanism, was embodied by gymnasia and academia (the correspondents of modern high schools and colleges), where the studies were made more pleasant by using varied methods of teaching and a greater emphasis was put on physical education. These schools, however, remained the privilege of the rich.

The Reformation, sparked by Luther and spreading from Germany throughout Western Europe, for the first time brought about widespread primary education, with schools freed from church domination and established in large numbers in towns and villages. Comenius (17th century), often considered the father of modern education, in his book Didactica Magna, outlined the system of universal education that now exists all over the world: primary schools in every parish, secondary schools in every town, universities in every city and supra-

universitary national institutions to advance the progress of knowledge (this template inspired, among others, the founding of the Royal Society in London) (Education 2008:103). Comenius' contribution to teaching methods is the proposal that everything that was taught should be presented to as many senses as possible, using pictures, models, workshops, music and other techniques.

2.3.5 The 18th and 19th centuries

The 18th century in Europe was an epoch of widespread ideas of secularism and rationalism. In the domain of education, this brought about the use of the mother tongue, the introduction of exact sciences in school curricula and the increasing preoccupation with finding the most adequate methods for teaching. It was the century of Enlightenment and of the Encyclopaedists (Diderot's Encyclopédie was written between 1751 and 1772). Jean Jacques Rousseau published Émile, or On Education in 1762, and that work remains a source of inspiration to this day to some curriculum theorists – if not to all: Darling, for instance, argues that the whole modern theory of education is nothing else but "a series of footnotes" to Rousseau's writings (Darling 1994:17). Émile is the story of the upbringing of a fictitious boy by which Rousseau illustrates an application to education of his theory that man, in his natural state, is good but is perverted by society. In order to allow him to discover, to consolidate and to preserve this natural good side of his character later, when he enters social life, Emile is educated in the countryside, far from the corrupt society in the cities, as well as far from his family and safe from contact with any books. There he is left to discover the world by direct experience, guided, however, by his preceptor. Building on this foundation, an education aimed at developing his intelligence and moral virtues at the same time, together with a manual skill, is designed. Attention is also given to physical exercise. A girl, Sophie, appears in the book as the woman who will complete Émile. Sophie, however, is not supposed to receive exactly the same education as the boy: she is taught to accept being governed, while he is educated to be self-governing, as Rousseau thought that subordination of women was necessary for private and public / social relations to function properly (Doyle 2007).

The preoccupation with finding the most appropriate methods of teaching loses its sporadic character in the 18th century and becomes a subject of systematic study with the opening of the first cathedra of pedagogy at the University of Halle (Cordasco 1976:86).

The 19th century was the epoch when education began to be seen as being the responsibility of the state. The ideal of general education for all became more of a reality, driven by the need to provide a more competent workforce able to master the increasingly complex requirements of the means of production of the industrial societies. Thinkers like Pestalozzi and Herbart propagated new principles of education, which acknowledged the potentialities of the students; the importance of developing their critical thinking; the necessity to connect symbolism with direct experience; the need to combine intellectual formation with moral education and with physical fitness (Cordasco 1976:102).

2.3.6 Curriculum theories in the 20th century and present times

The 20th century, the century of the two most destructive world wars, of an unprecedented population growth, of a worldwide spread of ideas of democracy, the century of the feminist movement and of the scientific and technological revolution, the century of globalisation, seemed exceptionally unsettled and has demonstrated the fastest rate of change in the history of mankind (Best 2008:1-4). Curriculum theorists became more numerous than ever before, arguments and counter-arguments chiselled the numerous facets of the subject. The role of the state in education was overwhelming and was also a stabilising factor: the state had to ensure that the tax money was spent on producing the type of worker and citizen that was required by the economic process and society structures. These developments continue into the 21st century.

Scott (2008), in his series of essays on the major curriculum theorists, identifies several currents of thinking and their implications. Scientific curriculum building is one of them. Its representatives, among whom the Americans Franklin Bobbitt and Werrett Charters are the most prominent, advocate the use of the scientific method in order to determine what needs to be taught and to structure educational knowledge. The activities of experts in the field to be taught are objectively examined, in order to derive a list of skills. These are broken down in constitutive elements; skills and elements are then moulded into specific training objectives and the curriculum is designed around them. An appropriate evaluation is designed in order to ensure that the learners have acquired the prescribed skills (Kliebard 2004:37-45).

For Bobbitt, education had no intrinsic value outside its function of preparing the young generation for adult life. He strongly argued for starting curriculum design with the

identification of objectives; his scientific curriculum building concept remains fundamental for most educators when planning their programmes. He thus inaugurated the technocratic tradition in curriculum development – the design of medical faculty studies is inspired by this tradition. Finally, he advanced the principle of division of curricula into pathways, e.g. academic versus vocational, with students being directed towards a particular pathway according to their abilities. This approach to education remains controversial to this day (Franklin 2003).

The critics of the scientific approach to curriculum building, including Dewey and Elliott, maintain that more complex learning outcomes may be difficult to describe in behavioural objective terms and therefore be neglected. The pre-specification of learning goals may lead to rigidly focused teaching and thus some valuable learning experiences that could be derived from classroom interaction may be discarded. If something cannot be measured it cannot be assessed and therefore, according to the scientific approach, it should not be part of the learning process. Lists of intended behaviours do not fit with the ways individuals learn (Scott 2008:10). Moreover, conceiving education only as preparation for adult life puts the learners on a sort of waiting list for real living, promoting detachment and diminished interest in what is taught. Dewey strongly opposed this approach: "Education...is a process of living and not a preparation for future living" (Dewey 2004:19)

Others, like Stenhouse (1975:143) in the United Kingdom, have suggested replacing behavioural objectives with processes that learners would be supposed to go through, thus increasing the degree of liberty of the pedagogic process and allowing for individual thinking and teacher contribution.

In opposition to the scientific approach is the concept that knowledge is intrinsically worthwhile (and the learning process does not have to result in a set of behavioural modifications in order to succeed). Aristotle himself said that the aim of education was the pursuit of rational activities that develop the mind. White, Hirst and Adey are the modern representatives of this, essentially liberal, approach to teaching. As the learner cannot know everything, domains of knowledge are delineated according to their distinctive mental or cognitive operations; students learn according to their type of intelligence: linguistic, logical – mathematical, spatial representation capability, musical analysis, etc. Another contributor to delineating the subjects to study is the existence of subsystems in the culture we live in, such as socio-political, economic, technological, moral, religious, and others. Progression within a

curriculum is organised around degrees of conceptual complexity, breadth and extent (Bailey 1984:68-82).

Even less structure in the curriculum might, in fact, enable the learner to use cultural resources in order to adapt better to the continually changing society and technology. The proponents of this innovative pedagogical experiment maintain that the traditional, strongly structured curriculum is not responsive to the needs of all pupils. According to this, the teacher plays the role of innovator, and, after reflecting on his/her pedagogic practices and curriculum content, will test new approaches. This is in direct opposition to technicist and market-dictated curricula and presupposes a degree of democratic interaction in class, as well as a certain level of education of those being taught (Elliott, in Scott 2008:15).

Another current of thought is the socio-cultural model of learning defined in the work of Jerome Bruner, inspired, among others, by Lev Vygotsky. Bruner published *The Process of Education*, in which he developed four themes, in 1960 (Smith 2002):

1. The teaching of structure (i.e. the components of a phenomenon or process and their reciprocal correlations) is important for the understanding of the reality: once the structure is understood, it can be populated with basic elements at an early age and more complex aspects of the structure may be presented as the mental capacity of the student develops.

2. "Any subject can be taught effectively in some intellectually honest form to any child at any stage of development" (Bruner 1977:33). Here he echoes the thinking of Jean Piaget; this idea and the previous one underpin his concept of "spiral curriculum", by which the teacher revisits concepts taught earlier in order to introduce more complex aspects.

3. Bruner insisted that curricula should support the development of intuition (as opposed to analytical thinking) prefacing the current knowledge that many thinking processes do not surface in the conscious brain until their final conclusion is attained.

4. Learning should be motivated by interest in what is being studied, as interest is the best stimulus for learning.

Bruner's latter work, as published in *The Culture of Education*, has its emphasis on the social and cultural context of learning: "What we resolve to do in schools only makes sense when

considered in the broader context of what the society intends to accomplish through its educational investment in the young. How one conceives of education, we have finally come to recognize, is a function of how one conceives culture and its aims, professed or otherwise" (Bruner 1977).

A further remarkable contribution to curriculum theory is that of Donald Schön, who emphasised that learning should be contextualised, and described a process of reflection-in-action (whereby strategies of solving a problem are reviewed in the case of failure) correlated with reflection-on-action (which may lead to a revision of fundamental concepts underpinning the failed action), both being valuable tools of learning. This concept, largely used today in continuous professional development courses, connects learning with its professional, practical, social or cultural context and highlights this connection as indispensable to the process of learning (Argyris 1978).

In an era marked by ideological confrontation and widespread ideas of equality and democracy, critical pedagogy has, understandably, found fertile ground. Its task is "to unmask hegemonies and critique ideologies with the political and ethical intent of helping to empower students and, more generally, the social groups to which they belong, by fostering awareness of conditions that limit possibilities for human becoming and legitimate the unequal distribution of social goods" (Lankshear, quoted by Scott 2008:14).

An idealistic view on the curriculum is that its role is to educate students to lead a fulfilled life. The main exponent of this instrumentalist view, John White (2004:22), defines the fulfilled life as one lived in autonomous well-being. To this purpose, a normative type of curriculum should include experiences that teach the students that which would allow them to lead a good life. The critics of this system of thought argue that the autonomous well-being cannot exist as such, but needs to evolve within the normative framework of human society. Even so, the difficulty persists in defining the right experiences to be presented in order to support the choices required for a fulfilled life.

The school effectiveness / school improvement current of thought, represented by Pam Sammons, does not concern itself with curriculum content or with scientific models of curriculum-making. About 12 to 18 per cent of the variance in student outcomes can be explained by school and classroom factors. Sammons produced a directory of effective school descriptors, among which feature professional leadership; learning environment; high

expectations; pupil rights and responsibilities; and school-based staff development (Sammons 1999:183).

The reality of learning, worldwide, is that, irrespective of the ideas circulated by many curriculum theorists, the contents and methods of the education process are determined, at a national or regional level, by governmental authorities. With regard to tertiary studies, there is more liberty of initiative in curriculum development; however, the standards ultimately are set by the accreditation and licensing bodies. All these compulsory standards are meant to ensure the creation of a product – the graduate – that can insert itself successfully in the social structures, make a useful contribution and thereby earn the means required for personal and offspring support.

As it will be seen below, the curricula in medical education are structured along the coordinates of the scientific curriculum making, although considerable distance has been covered since the initial work by Bobbitt. The continuous designing of medical education programmes may sometimes draw inspiration from the reflection-in-action and reflection-on-action principles formulated by Donald Schön. The same conceptual roots underpin the problem-based learning method.

2.4 Medical education curricula: a historical perspective

Examining the tradition in medical education and in medicine in general, will allow the gleaning of those elements which are perennial in and characteristic of the training in the profession and which constitute the cornerstones in the process of curriculum development.

The literature concerned with the history of medicine is considerable. The history of medical education, however, as a subject distinct from the evolution of medicine in general, has received far less attention. Until recently, only one comprehensive work existed; written by Theodor Puschmann, first printed in 1891, it reviewed the medical education from the oldest times to the epoch of the author. Another account of the evolution of medical teaching may now be found in Sir Kenneth Calman's book (Calman 2007). These are complemented by numerous short studies focusing on specific moments in history.

In the present short review of the evolution of the medical curriculum, attention will be given to what was taught, as well as to the methods of teaching and of evaluation of students in the past, in order to arrive at medical curricula in present times and identify the trends for the future.

2.4.1 Ancient times

Numerous elements of present-day medicine and medical teaching can be identified in accounts dating back several millennia. In ancient China, the oldest medical treatise known to date, Nei Ching or The Yellow Emperor's Canon of Internal Medicine, is preserved in a manuscript dating from around 1000 BCE, but is thought to have been written much earlier by the Emperor Huang Ti (2695 – 2589 BCE) and his minister Ch'I Po. It contains information on pathophysiology, anatomy, health conservation and treatment principles, pulse interpretation, diet, acupuncture and others. This remarkable book is still in use in China, in the teaching of traditional medicine. Significant for the subject of the present doctoral writing are the notes on blood circulation, made more than 3000 years before Harvey: "The blood flow is under control from the heart...blood flows continually in a circle and does not stop" (Wong 1932, quoted by Calman 2007). The training of future doctors is supposed to have lasted nine years, and the method was one-on-one interaction between

student and master. An imperial examination was held for doctors, as part of the examination for imperial office bearers. This was an oral and practical examination: only the best were hired by the government, to become teachers or to author books on medicine; the second-best were given a license to practise. Those who failed were ordered to change profession (Calman 2007:17-21).

In India too, medical knowledge was collated in writings used for training purposes. The Rig-Veda, the oldest medical work in Sanskrit, dating from around 1500 BCE (Calman 2007:16), contained information about dietetics and medicinal remedies. The Ayurveda, dating from around the year 600 BCE, was more comprehensive, containing also information about surgical interventions. In this work, Charaka, the physician, indicated the best ways of obtaining medical education: the study of the medical writings; personal teaching by an instructor; and association with other doctors for discussions. From Susruta, the surgeon, we find out that the ethics of practising was spelled out in an initiation ceremony of the future doctors. The theoretical training consisted of loud reading by the teacher, of extracts of the medical writings, which the students then memorised and had to demonstrate that they grasped the meaning thereof. The teacher also personally instructed the carrying out of surgical interventions. At the end of their studies, the graduates had to petition the king to grant them authority to practise independently. The existence of infirmaries is mentioned, but there is no information on the extent to which they were used in the training of future doctors (Puschmann 1891:8-13, Rao 1968).

In ancient Egypt, the existing scientific knowledge was compiled in 42 sacred books, out of which six contained medical information and were used for training future doctors in temple schools. Numerous patients were brought to temples to be healed, and they offered the students an opportunity to practise. The Jews made medical education a component of general education. Special emphasis was put on hygiene. The schools were initially in temples, but lay schools and lay doctors later came into existence. Many elements of Greek medicine were taken over in the Talmudic medicine (first century BCE). Dissection was practised, also on animals, and this offered an anatomical basis for the progress of surgery. The medical graduates had to obtain permission to practise from the magistrates of the towns where they intended to settle, but it is not known if they also had to sit for examinations (Puschmann: 27-32). In Persia, Egyptian, Greek and, later, Jewish doctors were employed by rich lords. The other, local, doctors were mainly priests, herbalists and surgeons. The training took place in temples. There was no examination for licence, but the surgeons had to prove

that they had successfully cured by knife three members of the lower classes. Should three such patients have died as result of the operations, the doctor was never again allowed to practise (Sigerist 1987:202-205).

Ancient Greek medicine has been recorded in history related mainly to Hippocrates, but the profession of healing was practised in Greece long before his time. Doctors – Asclepiadae – were considered descendants of Asclepius, the demi-god son of Apollo. They mainly established themselves next to Asclepiaia, temples dedicated to Asclepius, where sick people often gathered or were brought to seek for a cure. The remedy was supposed to reveal itself to the patient during a dream and, if not, dreams were interpreted by the doctors in order to pinpoint their curative hints. Asclepiadae also taught medicine, which was comprised, to a large part, of the interpretation of dreams, herbalism and some surgery. They provided direct supervision of the practice of their students. Many philosophers were also doctors and medicine profited from this combination. Hippocrates, who lived during the age of Pericles (around 400 BCE), at the summit of ancient Greek civilization, brought to medicine the benefits of careful observation combined with the dialectic method of thinking (for which Socrates, its promoter, received capital punishment). He authored numerous medical writings, which remained in use in the instruction of future doctors long after his death. He also formulated the ethical requirements of medical practice, summarised in the Hippocratic Oath (Marketos 1999). Hippocrates gives an account of the blood circulation, again long before William Harvey (Cheng 2001). Not all doctors were allowed to teach, but only those who were in actual practice and who appeared to unite knowledge and experience. The study of medicine started with that which was normal (normal anatomy for instance) and progressed to disease. The students received practical supervision in their masters' iatreia, which were doctors' rooms and residences, where patients arrived for treatment. Medicine and philosophy were often taught together and Aristotle, for example, was not only philosopher but also a doctor and the founder of comparative anatomy. There were no examinations before being allowed to practise and whoever thought themselves to be properly trained could practise as doctors. (Puschmann 1891:60-72). With the decline of Greek civilization and inclusion of Greece in the Roman Empire, many doctors emigrated to Rome and Alexandria.

The Romans did not produce prominent doctors but were happy to rely on the numerous Greeks spread throughout the Empire, whose knowledge and skills were incomparably more advanced than those of their conquerors. Galen (129-216 CE), whose writings, covering 21 volumes of over 1000 pages each, established himself as the ultimate authority in medicine in

the western world for the following 15 centuries, was also of Greek origin. He (and presumably members of his school) wrote on philosophy, anatomy, physiology, materia medica, practical medicine, surgery, gynaecology, history of medicine and other subjects (Nutton 2009). These texts, together with Dioscorides' treatise on pharmacology, formed the backbone of medical science for a very long time. The teaching was provided by the practising doctors in their tabernae medicae (the equivalent of iatreia). As there were no legal ordinances regarding the requirements to qualify as a doctor, anyone who had some training could treat patients and presumably also teach. It was customary for young people to first acquire an education in law, military science, agriculture and some medicine, which was then completed by a course in philosophy. Only afterwards did they dedicate themselves to the study of medicine. This consisted of anatomy and physiology, pharmacology, internal diseases, surgery and midwifery. Besides the tabernae medicae, the practice on patients took place in the convalescent rooms for slaves in the houses of the rich, and – probably mainly – in the patients' homes, where the doctor brought his students, sometimes igniting thereby the discontent of the sick (Puschmann 1891:113).

2.4.2 Medical education in the Middle Ages

The early Middle Ages are defined by three historical events: the disintegration of the Roman Empire (except for its Byzantine part); the migration of nations; and the spreading of Christianity in Europe. None of these was favourable to the progress of medicine: the fall of Rome and the invasion of less civilized nations undermined the socio-cultural basis for the development of science for many centuries. As for the Christian religion, the emphasis on the after-life was associated with a view that life and the human body were connected to sin and disease was sent by God. Furthermore, the condemnation of ancient Greek literature as being heathen and the prohibition of dissection created a strong basis for discouraging scientific medical preoccupation. The legacy of Galen survived, though, due to the fact that he showed admiration for God in his writings. Medical education continued, initially in the forms it had during the Roman Empire, mainly under the guidance of Archiatri (doctors employed in public service). The multiplication of hospitals, supported by the Christian doctrine of charity, increased the opportunity for doctors to come in contact with patients with various sicknesses and thus to acquire better practical knowledge of diagnosis and prognosis.

While most of Europe was going through a time of stagnation, civilization was flourishing in the Arab world, and with it medicine and medical education. From the Arabic Peninsula through Northern Africa to Spain, Arab territories did not experience the migration of nations. Medical science prospered in centres like the Academy of Gundisapur, Alexandria, and later in Spain. In many centres, the works of Greek and Roman authors were translated into Arabic and received further additions. Prominent figures of those times were Avicenna (Ibn Sina), Averroës and Maimonides. They are best remembered as philosophers but also left their mark in the medical field. The best known of all is Avicenna, whose treaty, The Canon, is an encyclopaedia of Greek and Roman medical knowledge, to which he added his own observations (Amr 2007). The Arabs were the first to introduce measurement and experiment into the investigation of nature (Puschmann 1891:162). In the early epoch of Arab civilization, medical schools were located in mosques. Lectures were given, and the students were expected to take notes. At the end of lectures, the teacher asked questions on the material taught and discussions followed. Libraries were available. In the 11th century, madrasahs were established, where students and teachers lived together; they were separate from the mosques. However, apparently medicine was not taught in madrasahs. The "House of Wisdom" in Cairo, opened in 1105, bore close resemblance to a University. There, paid teachers were giving tuition and the large library had 18 rooms (Meri 2006:450-451).

Practical medicine was learnt by following a doctor in his daily activities, at medical school or in a hospital, but most often by a combination of the three. The hospitals were organised on principles that are being followed to this day: the sick were separated according to their ailments, there was a women's ward, a kitchen and a dispensary. A high official (kadi) was often entrusted with the administration of the hospital. While medical examinations for licensing generally did not exist, they were introduced in places. In Baghdad, for instance, after the death of a patient, in 931 CE, all doctors had to take an examination in order to be allowed to continue practising. Examinations are mentioned to have been held in Cordoba too. Alternatively, in other places, doctors had to produce certificates to prove that they had studied with a teacher. Arab medicine succumbed to invasions by the Crusaders and later by the Turks.

Beginning in the 10th century CE, Universities were established in Europe, where medicine was taught at a higher level. The archetype of these universities is the medical school of Salerno, in the south of Italy. Salerno was renowned in the 10th century for its doctors and many of them were invited to attend to the health of important personalities far away in

Europe. Other potent people of the time travelled to Salerno in search of cures. Gradually, more and more students arrived to be taught there. This is when King Ruggiero promulgated a law stipulating that whoever wanted to practise medicine should first sit an examination with designated officials of the Court (1140 CE). Emperor Frederic II, one hundred years later, issued clear rules regarding the subjects studied and the examinations, thus establishing the first structured curriculum of a medical school: students were not to be admitted to study medicine before having studied logic for three years; the total duration of the medical curriculum should be five years and it had to be based on the genuine works of Hippocrates and Galen; it had to include knowledge of surgery. To be granted permission to practise, the candidate had to pass an examination organised by the authorities and be in possession of a certificate stating that he/she studied for the whole prescribed period. Moreover, in the first year of practice, the graduate was to consult a more experienced practitioner before managing his or her patients at most times. These rules were, in fact, legal requirements and their transgression was punished with one year of imprisonment and confiscation of property (de Divitiis 2004).

While the school of Salerno was the first to be organised in this way, other universities soon opened in Italy and in most of Europe, all with defined curricula along the rules first formulated by Frederic II and with a structure that is reproduced to this day: paid teachers, Chancellors, Deans and student organisations (Romero-y Huesca 2006, Puschmann 1891: 213-36). Preliminary studies in philosophy were a requirement for admission in many such institutions. Teachers read from Avicenna, Galen and Hippocratic Aphorisms, commented on by Arab and later erudite authors. The students took notes: no books were available to them. Lectures in practical medicine were also held, concerning pathology, infectious disease and therapeutics. The lectures alternated with discussion in the scholastic tradition (Louryan 2008). Much of the practical experience was not acquired in the medical school, though, but afterwards, mainly in the hospitals that opened in most cities, under the supervision of skilled doctors. After the first two years of study and having passed examinations, the student acceded to the title of Bachelor and, after a further two to three years, to that of Master.

The title of Doctor of Medicine initially was not a scientific one, according to Puschmann (1891:263), but was conferred to candidates of "honourable and legitimate descent, of irreproachable character and respectability, at least 26 years old, without bodily defect or deformity". The ceremony comported a discourse by the candidate followed by a public discussion and various other ceremonial gestures, after which a banquet took place, to which

all members of the faculty were invited and the highest in rank received expensive presents, all paid for by the freshly promoted doctor.

2.4.3 From the Renaissance to 19th century

The 16th century marked a revival of interest in Greek and Roman literature, art, philosophy and science. Together with these, a renewed preoccupation with the investigation of nature led to numerous advancements in science in general, including medicine. Autopsy became much more widely practiced and, as a result, the knowledge of anatomy progressed enormously in comparison with the Middle Ages. Andreas Vesalius was thus able to demonstrate, in "De Humani Corporis Fabrica", numerous new anatomical findings, as well as numerous errors made by Galen. Surgery benefited considerably from this expanded knowledge. Physiology, however, had still to wait for the advent of the experimental method, in the following century, to register notable progress. Pharmacology, based on better botanical knowledge and on some progress in chemistry, was a prominent matter for study in the faculties of medicine. An inestimable contribution to the progress of science and to the improvement of learning was the invention of mobile type by Gutenberg in 1440: it made the printing of books much faster and cheaper and enabled the institutions of higher learning to establish libraries and to facilitate access to knowledge for their students.

The Renaissance opened the door to an ever-increasing effort to understand Nature. In the 17th century, the accumulation of knowledge in various domains led to substantial progress in medicine too. Discoveries in chemistry and physics contributed to the production of new medicines. The invention of the microscope by Leeuwenhoek made possible the investigation of tissues and thus set the foundation of histology and anatomical pathology. The use of the experimental method led to the advancement of physiology and pharmacology. All these made their way into the curricula of the medical schools. This development of science made it necessary for the professors to specialise: it became impossible for a teacher to lecture about almost any subject, as in the past. Gradually, medical schools in their curricula incorporated the practice of patient care, which in the past was learnt by the student outside the faculty, by association with a practising doctor. Patient demonstrations by teachers, work in clinics established alongside the faculties, or supervised hospital practice under guidance by faculty staff gradually gained ground and became the norm in the 18th century. Surgery continued to develop as a separate profession. Later it would be integrated into the medical

curriculum, and the faculties thus integrated called themselves schools "of medicine and surgery" (Calman 2007: 87-134).

Innovative teachers were even using what could have been a problem-based learning method "*avant la lettre*". An account of the way F. De le Boe conducted his clinical teaching in the 17th century in Leyden reads as follows: "when he came with his pupils to the patient and began to teach, he appeared completely in the dark as to the causes or the nature of the affection the patient was suffering from, and at first expressed no opinion upon the case; he then began by questions put to different members of his audience to fish out everything and finally united the facts discovered in this manner into a complete picture of the disease in such a way that the students received the impression that they had themselves made the diagnosis and not learnt it from him" (Puschmann 1891:413).

The 18th century saw the gradual loss of importance of the Hippocratic and Galenic writings, in favour of a return to patient observation and reflection around the findings. Perhaps the most prominent personality driving this change was Herman Boerhave (1668-1738) who taught medicine in Leyden. He moved, in his teaching, from the classical dogmatism to the practical knowledge derived from the interaction with the patient. Several of his pupils were appointed professors in Edinburgh and continued his method. They authored books that crystallised new medical knowledge: "A System of Surgery" was written there by Benjamin Bell and "First Lines of the Practice of Physic" by William Cullen. There were many such examples across Europe. Classical texts continued, nevertheless, to be studied in faculties. An example is the curriculum in medicine at Oxford in the 18th century, consisting of Anatomy, Chemistry and Botany, together with studies of Hippocrates and Galen (Warren 1951). Latin was gradually abandoned in the classes, in favour of the national languages.

The 19th century is considered a watershed in medical education. Hospital-based training expanded and became the main method of teaching. The evaluation of the patient follows the clinico-pathological method: history, examination and investigations are all considered in order to reach a diagnosis. Numerous medical specialties date from this century. A curriculum of basic sciences takes contour: physiology, pathology and microbiology find their place in medical education. By the middle of the 19th century the classics were completely relegated to medical history. Numerous medical periodicals were established in this epoch, illustrating the volume of medical research and making it increasingly necessary to continue to assimilate the progress in the profession after having completed the study of

the manuals (Gourevitch 1999, Calman 2007:215). In Great Britain, the establishing of The General Medical Council in 1858 opened a new era in which medical curricula and medical examinations became more structured and of a higher standard (Gregg 2008).

2.4.4 The 20th century and present times

The Flexner Report is the significant event in the history of medical curriculum thinking which opens the 20th century. In the 19th century, in the United States of America, the number of medical schools increased to 155. Most of these institutions, however, were profit-driven; their training was of the lowest quality and their graduates could not practise medicine safely. The Carnegie Foundation for the Advancement of Teaching commissioned Abraham Flexner, an educationalist, in 1908 to inspect the American and Canadian medical schools and to draw up a report on the state of medical teaching, with proposals to improve it. Flexner personally inspected all medical schools in the United States of America and Canada, looking at several characteristics: i) entrance requirements; ii) faculty members: their number, training and working hours (full-time or not); iii) financial status of the institution; iv) laboratories and equipment; v) library and vi) access to hospital bed patients, as a requirement for practical teaching (Parker 2000). Among the most important recommendations of his report, which was released in 1910, were the following:

- The Medical School should actually be a University Department.
- The minimum entry requirement should be two years of College study comprising science
- Laboratory disciplines of medicine should be part of the curriculum.
- The laboratories and clinics to be adjacent to each other.
- These schools should be in cities in order to be accessible.
- There should be only one school in a given locality.
- Facilities should be made available to students to allow them to study in their own State.

He then went on to make recommendations for every state and every school. In his work he was inspired by the Johns Hopkins School of Medicine, whose pupil he had been: indeed Johns Hopkins had high entrance requirements and highly trained faculty (mostly in Europe). Their students applied the clinical-pathological method in the evaluation of patients. They

had access to the Johns Hopkins Hospital, where their activity was closely supervised by experienced doctors. Johns Hopkins graduates were generally better doctors than those of other schools.

The consequences of the report were revolutionary. Fourteen years later, Flexner evaluated them in another survey: only 80 medical schools survived, the others disappeared in a "rattle of dead bones" (Flexner, quoted by Parker 2000). Over 90 per cent of the medical faculties now required preliminary College training for admission. The equipment and facilities had improved substantially, laboratory medicine was being taught by full-time, well-trained teachers; preclinical years and clinical years were provided for in the curricula (Barzansky 1992).

Flexner did nothing more than identify the requirements of a 20th century medical education, as they became more and more obvious for many in America and Europe, and drawing the attention of the governments and big private donors on how the funds should be spent. The same developments in medical training took place in Europe, independent of the changes on the other side of the Atlantic.

At present, medical education is structured in four stages: premedical, undergraduate, postgraduate and continuing medical education (Gregg 2008). The premedical course is meant to prepare the basis for the study of preclinical disciplines: chemistry, physics and biology usually are required for admission to a medical school. The undergraduate course usually contains a two-year preclinical phase, during which the structure and the function of the normal human body are studied: anatomy, histology, embryology, biophysics, biochemistry, physiology and pharmacology are usually part of the curricula in this phase. Further matters studied at this stage are anatomical pathology, bacteriology and parasitology, immunology, as well as ethics, biostatistics, public health and others.

The next two to three years are spent in hospitals, where the students become acquainted with all aspects of diagnosing and managing disease. Stages are organised to offer exposure to all specialities of medicine. Examinations are held at the end of each stage and at the end of the year. In The United States, certification examinations are organised by a national agency in view of licensing graduates to practise. A year of supervised practice after graduating is a widespread prerequisite for licensing.

Postgraduate courses are the pathway to specialisation in a certain branch of medicine – surgery or internal medicine, for instance. Further super-specialisation is possible through fellowships. Continuing medical education is the main requirement for maintaining a license to practise.

2.4.5 Conclusion

Medical knowledge has made considerable progress in the last few centuries, based on the development of other domains of science such as, among many, biochemistry and biophysics, physiology, microbiology and pharmacology. As opposed to other human activities, which were completely changed by technology – in automobile manufacturing, for instance, where robots have taken over most operations – medicine essentially has remained, through the millennia, an interaction between people, whereby the sick receive health care from a team of trained individuals. As a result, medical training involves direct interaction between student and patient, which, in turn, requires close supervision, ideally one-on-one, by experienced doctors. This interaction and supervision take place within a defined socio-cultural context where tradition plays a significant role. It has to be backed by a thorough knowledge of the structure of the human body and its functioning in health and disease, as well as of its interactions with the environment and with other humans. The knowledge and skills of future doctors need to be assessed repeatedly as they progress through the study of various disciplines. The State often played a role – and continues to do so – in the assessment for licensure, as well as in drawing up guidelines for the curricula of the medical training entities. When the State did not directly intervene, professional organisations were entrusted with this task (e.g. the General Medical Council in the United Kingdom or the National Board of Medical Examiners in U.S.A.)

2.5 Contemporary medical curriculum design

The well-known Declaration of Alma-Ata – present-day Almaty, the capital of Kazakhstan – adopted by an International Conference on Primary Health Care in 1978, expresses the consensus that health is a fundamental human right and that "governments have a responsibility for the health of their people which can be fulfilled only by the provision of adequate health and social measures" (Declaration of Alma-Ata). This modern-day echo of

the historical preoccupation of governments of the world with the health of their subjects underscores the necessity that medical curricula in faculties should enable graduates to act efficiently within the social effort to preserve health and to fight disease.

The process of curriculum development is thus informed by the requirement to attain a certain level of competence – which is being monitored by an administrative authority – and has to define clear domains of knowledge and skills to be acquired by the future doctor. Then the content of the curriculum, its teaching methods and its assessment system are all aimed at handing on this knowledge and skills to the student. Such terms of reference dictate a strong adherence to scientific curriculum-making principles.

2.5.1 The Johns Hopkins medical curriculum design approach

There are four elements which need to be addressed in the process of curriculum design: content, teaching and learning strategies, assessment processes and evaluation processes (Prideaux 2003). All modern thinking in this domain revolves around these components of curricula. The most comprehensive and widespread model of medical curriculum development was created by a group of specialists at the Johns Hopkins University Faculty Development Program for Clinician-Educators (Kern 1998). They envisaged a rational curriculum design approach in six steps. The analysis which follows is focusing mainly on the framework proposed by the Johns Hopkins group.

2.5.2 Theoretical underpinning

The group's research draws on previous work by curriculum specialists, such as Ralph Tyler (1949) and Hilda Taba (1962), who proposed ***a rational model in curriculum design*** which would start with defining objectives and continue to selecting learning experiences that may help attaining those objectives, then to organising these experiences and concluding with evaluation in order to find whether the learning objectives were attained (Print 1993, pp. 64-66). The main criticism of this approach was its linear character: in practice, teachers have difficulty in following this logical, sequential process.

A cyclical curriculum planning process was envisaged by D.K. Wheeler (1967) and perfected by Nicholls and Nicholls (1978). The steps proposed by Wheeler were largely

similar to those delineated by Taba and Tyler (1962) but this time in a cyclical arrangement which highlighted the idea of interdependence between the steps and of curriculum evolution as the cycle repeats itself. Audrey and Howard Nicholls introduced an important preliminary step in curriculum design: situation analysis, which is an initial (or, due to cyclicity, periodical) tour of the horizon of all factors that determine the choice of curricular objectives (Print 1993, pp. 70-72). This very step constituted, however, the basis for criticism, as the collection of facts and opinions is time- and energy-consuming and teachers would prefer to appeal, at this point, to their own experience and intuition. Apart from this, the cyclical curriculum still requires structure in planning and many find it difficult to adapt to this constraint.

In fact, direct observations of the process of curriculum development, as it takes place in learning institutions, have revealed ***a different, "natural" way*** of doing it. According to Decker Walker (1971), teachers would first agree on a "platform" of beliefs, theories, conceptions, points of view and objectives. Once this platform is established, rather random interaction follows, during which they would argue, even fight, for their own point of view; compromises are being made and new solutions are being agreed upon. The last phase is when, as a result of the interactions described, decisions are taken which crystallise the elements of the curriculum. Malcolm Skilbeck (1984), while remaining a supporter of this "dynamic" curriculum development process, sees it rather as a loose interconnection of five steps: situation analysis, goal formulation, programme building, interpretation and implementation and monitoring/ feedback/ assessment/ reconstruction. Similarity with cyclical curriculum building seems obvious, but Skilbeck insisted that teachers may start the process wherever they want to and proceed in any order, as long as all the steps are completed (Print 1993:74-78). The dynamic curriculum-building process was criticised for its lack of structure, as the process may yield confusion in the absence of goals and possibly to "pooled ignorance" (Print 1993: 81).

2.5.3 The six-step approach

Kern and colleagues acknowledge that their inspiration came from such works. The model they proposed is in fact a synthesis of the various approaches described above. It comprises six steps (see Table 2.1, page 41): general situation analysis; evaluation of learner needs; formulation of goals and objectives; choice of educational strategies; implementation and

evaluation; and feedback. Its structure remains cyclical, however "these steps do not always follow one another in sequence, but do constitute a dynamic, interactive, and systematic process" (Thomas 2004). The content of each step is detailed below.

The ***situation analysis*** remains for Kern the most important step, one that also informs the other steps of choosing educational methodologies, finding faculty development resources, potential funding resources, and identifying opportunities for dissemination of the curriculum. The methodology proposed for implementing this step is summarised in Table 2.2, page 43.

The next step in accumulating the necessary information for the designing of the curriculum is the ***evaluation of the student needs***. Their level of competence when entering the programme; their ability to undertake self-directed and group study; their individual goals and priorities, including reasons for enrolling; their attitude towards the discipline; and their assumptions and expectations from the programme are important in order to determine the methods of teaching and evaluation (Amin 2003:60). Written questionnaires might be useful in this step: for more specialised courses, they might be oriented by a job analysis (DaRosa 1995).

On the basis of this comprehensive analysis, ***the goals and objectives of the course*** can be formulated. They should cover three areas: knowledge, skills and attitudes. This step is crucial for the selection of the most effective learning methods, as well as for the adequate choice of assessment modalities.

The choice of ***teaching strategies*** must be aligned with the objectives, as stated above. The methods employed must be diverse, as required by the matters to be taught, knowing also that the ways students learn differ according to their individuality. On the other hand, the methods chosen need to take into account the available material and human resources (Amin 2003: 61). The potential to alienate faculty who do not cope with curricular changes is real, and it was advocated that teachers should be involved early in the development of new curricula and that they should receive training in the required new teaching methods. Sometimes counselling or even an opening for an alternative career should be considered (Lanphear 1987)

Students learn with examinations in mind and therefore ***the assessment methods*** should be carefully planned, on the basis of the objectives of the course. They should address essential

knowledge, skills and behaviours as they should be mastered in practice by the future graduates. The assessment shall be planned at the beginning of the course, not at the end, and the learners need to be informed of the ways in which their evaluation will be done.

Finally, ***the evaluation of the curriculum*** has to be planned for. This should be an ongoing process and not be left for the last days of the course. A model of such ongoing evaluation was described recently (Lieff 2009). For a course extending over two years, obtaining feedback only at its end would not have allowed for the necessary time to effect changes before the commencement of the next course period. Therefore, a half-hour was set aside weekly for "housekeeping", during which students could raise issues about any aspect of the course. Reflection papers on the course were elicited from the students every trimester; interviews with opinion leaders were held annually; modified Delphi surveys were run at strategic moments during the course period, investigating the need for extra topics. The findings were summarised and discussed with the faculty, making possible adjustments while the curriculum was running.

The evaluation may be done not only by the learners or faculty involved, but it may involve faculty from related disciplines (Burke 2002). An anticipatory evaluation, before the course actually starts, may be organised, involving students and faculty who did not participate in the development of the curriculum (Hollander 2002).

The principal merit of this approach, besides defining the internal architecture of the process of medical curriculum design, is the recognition of a general needs assessment, as well as of an assessment of learner needs, as the basis for structuring the programme. The curriculum is not a rigid entity; on the contrary, it needs to evolve, to adapt in order to continue to fulfil its role. This evolution requires feedback. The sixth step in the Johns Hopkins model, the evaluation of the curriculum, brings feedback on the internal functioning of the system, i.e. how well it works to assist the learners to achieve the desired objectives, how well the lecturers are coping, adequacy of resources and others. The first step, the needs assessment, repeated at regular intervals (as prescribed by the cyclic character of the curriculum design), ensures that the programme remains attuned to the requirements of the society at large, of the accrediting and licensing organisations, to the requirements of the practitioners in the field and to those of the patients .

The concept of needs assessment was promoted by Taba (1962), under the term of diagnosis of needs, and it referred to the assessment of the needs of the learners, as the first step in the

development of a curriculum. The idea was further developed by Reynolds and Skilbeck (1976), who envisaged a broader analysis, comprising external factors (to the educational institution) such as societal expectations and changes; expectations of the employers; community assumptions and values; and internal factors, like students, teachers, resources, and institutional ethos (Prideaux 2003, 2007). The critics of this approach maintain that many of the possible findings of a needs analysis are, in fact, already known by the teachers from experience and intuition and that the time and resources spent in doing it are not justified by the results (Marsh 1992:79). To date, no comparison between the results of a needs analysis and those of surveying the opinions of the teachers on the needs in question has been published and this is one of the objectives of this research.

Table 2.1: Six-step approach to curriculum development for medical education (Thomas 2004)

Step	Title	Tasks Involved in the Step
1	Problem identification and general needs assessment	Identification and critical analysis of the health care problem that will be addressed by the curriculum. Requires substantial research to analyse what is currently being done by practitioners and educators, i.e., the *current approach*, and what should be done ideally by practitioners and educators to address the health care problem, i.e., the *ideal approach*. The general needs assessment is usually stated as the knowledge, attitude, and performance deficits that the curriculum will address.
2	Needs assessment of targeted learners	The general needs assessment is applied to targeted learners.
3	Goals and objectives	Overall goals and aims for the curriculum are written. Specific measurable knowledge, skill/performance, attitude, and process objectives are written for the curriculum.
4	Educational strategies	A plan to maximize the impact of the curriculum, including

Step	Title	Tasks Involved in the Step
		content and educational methods congruent with the objectives, is prepared.
5	Implementation	A plan for implementation, including timelines and resources required, is created. A plan for faculty development is made to assure consistent implementation.
6	Evaluation and feedback	Learner and programme evaluation plans are created. A plan for dissemination of the curriculum is made.

Table 2.2, page 43 lists the various methods which might, according to Kern and collaborators, be necessary to use when performing a needs analysis. They stress that the review of the available information and the consultation of experts are, in fact, the usual methods which will be used, and that they would, in most instances, be sufficient to perform a valid general needs assessment exercise. Done in this way, the analysis should not require excessive time or resources. Going through the literature, reviewing the curricula of other similar institutions and other published curricula, consulting the standards set by the regulatory authorities or meeting with experts in the particular field where the curriculum is positioned, should be an easy intellectual exercise.

The real consultation with the stakeholders, according to Kern and collaborators (1998:15), is necessary only when the resources mentioned above do not offer sufficient data to ensure a comprehensive grasp of the general needs. The difficulty that is easily identified here is: how does one know that sufficient information was accumulated to ensure an effective curriculum? The answer to this question is not offered by the authors. Indeed, some incertitude may remain even after going through the first two phases of the process outlined above. It appears unavoidable, therefore, to perform the third step described in Table 2.2, page 43, from time to time, in order to ensure that the curriculum remains relevant to its beneficiaries – the doctors and their patients.

Table 2.2: Methods for obtaining the necessary information for a situation analysis (Kern 1998:14)

Review of available information

- Published literature
- Reports by professional societies or governmental agencies
- Documents submitted to educational clearinghouses
- Curriculum documents from other institutions
- Patient education materials, prepared by foundations or professional organisations.
- Public health statistics
- Clinical registry data
- Administrative claims data

Use of consultants / experts

- Informal consultations
- Formal consultations
- Meetings of experts

Collection of new information

- Surveys of patients, practitioners or experts
- Focus groups
- Nominal group technique
- Group-mailed Delphi technique
- Daily diaries by patients and practitioners
- Observation of tasks performed by practitioners
- Time and motion studies

- Critical incident reviews

Study of ideal performance cases or role model practitioners

2.6 Contemporary determinants of change in medical education

A number of factors which drive the need for medical curriculum change may be easily identified at the present time. The most important one is the progress of science, whose pace is faster than ever before. This results in a better understanding of disease, more accurate means of diagnosis and more efficient prevention and therapy. All these elements of progress have to find their way, as soon as they have proven their value, in medical students' training.

2.6.1 Evidence-based medicine

The medical practitioner is presented with an ever-increasing multitude of new scientific discoveries, new opinions, new medicines and new therapeutic procedures. Moreover, scientific research continuously analyses the existing diagnostic and therapeutic means in order to evaluate their effectiveness. An immense body of scientific data has accumulated, mainly from the second half of the past century to the present time. All this information is currently available in electronic form, making its retrieval and comparative evaluation infinitely easier than before. Pub Med alone gives access to 16 million medical research abstracts. It is now possible to combine the evidence from any number of similar studies in order to attain a valid conclusion. The Cochrane collaboration, founded in 1993, is dedicated to evaluating the best evidence, from meta-analysis of randomised controlled trials, of the effectiveness of health care interventions (www.cochrane.org). A vast number of other meta-analyses are available in the literature, to complement the Cochrane database. The end-result of this evidence-based approach to the practice of medicine is a better utilisation of resources in health care. The fact is therefore undisputed that the information passed on to the medical students must contain the latest evidence on all matters taught. This supposes a frequent revision of the textbooks and other material used in the education process, in order to update it with the most recent findings on the effectiveness of health care. Furthermore, the student must be trained in assessing the value of scientific studies, in order to learn how to form an opinion independently on the validity of the data published and later to be able to decide which research to apply in her/his practice. In other words, the student must acquire the habit of an evidence-based approach to managing patients. The efficacy of this process depends to a large extent on the information management skills of the student, and these should be taught together with the evidence evaluation skills (Bradt 2003).

2.6.2 Life-long education

The same high – and ever-increasing – output of medical research mentioned above makes it indispensable for medical practitioners to stay permanently attuned to the progress of knowledge and technology in their field. Medical licensing authorities have, in many countries, decided that continued medical education is mandatory for doctors who want to maintain their authorisation to practice.

The challenge for health faculties is to develop curricula targeting the real needs of the various practitioner groups and then to use the most efficient methods in order to ensure that the desired knowledge and behaviours are assimilated by learners. The reviews of the literature on the effectiveness of continuing medical education programmes show that successful programmes, apart from responding to existing needs for updating, are based on solid theoretical grounds and focus on that what needs to be learned (Amin 2000). The didactic methods used matter too: interactive sessions, using multiple methods of instruction, for small groups of doctors within a single speciality appear to be more efficient (Ghosh 2008). A comprehensive review of the literature on the effectiveness of continuous medical education found that live media were better than print and delivering the message by multimedia was better than by a single medium. Multiple exposures were more effective than one single exposure in modifying the knowledge, attitudes, skills and behaviours of the learners (Marinopoulos 2007).

2.6.3 Complementary and alternative medicine

These terms are used to describe a number of health care activities that fall outside the conventional Western medical practice. The term “alternative” tends to be replaced increasingly by “complementary”, in order to convey the fact that these remedies are being sought by patients alongside the usual health services. The list of components of complementary medicine is considerably long, starting with acupressure and acupuncture, going through chiropractic, herbal medicine, allopathic medicine and ending with Reiki, Shiatsu and Yoga (Zollman 1999). The usage of complementary medicine has known a revival in Europe and Northern America in the last decades, for a number of diseases, but especially among patients with cancer (Vapiwala 2006). In other cultures, such as those of nations living in the Far East and Africa, this approach to healthcare is in fact traditional and

uninterrupted. In sub-Saharan Africa, some estimates put the usage of traditional healers, as a complement to Western medicine, at 70% (Mills 2006).

While the training in these complementary health services has been, and still is, largely done outside the health faculties that teach conventional medicine, more and more Western health training institutions offer courses in some of these alternative domains. In the United States, for instance, the National Center for Complementary and Alternative Medicine has given grants to 14 Health Faculties between 2000 and 2003 to enable them to include training in complementary medicine in their curricula (Pearson 2007). There were a number of difficulties with starting such programmes from scratch but they are up and running (Lee 2007, Sierpina 2007). Similar programmes were introduced in Canada, Germany and United Kingdom (Frenkel 2001). There is a paucity of trained tutors, of bibliographic sources and of validated examination methods (Sierpina 2007) but, foremost, a lack of systematic evidence, from randomised trials, on the effectiveness and lack of risk of alternative medicine (only just less than a thousand such studies can be retrieved on PubMed; they appear too few when compared with the vastness of the domain).

2.6.4 Problem-based learning

This new approach to learning was first launched in 1969 at McMaster University in Ontario, Canada. It came into existence as a solution to the perception that the traditional medical curriculum, based on lectures and discipline-related delivery of the information, was inefficient. That was due mainly to the curriculum allowing the learners to become passive; they were not stimulated to integrate the basic science knowledge with the clinical knowledge and also did not readily apply this information to the solving of patient problems. The motivation for learning was achieving pass marks in exams, rather than acquiring the skills necessary for practice (Amin 2003:215). Since then, in the search for active involvement of the students in the learning process, numerous universities around the world have adopted problem-based learning, either as the single method used for teaching or as part of hybrid curricula, alongside the traditional method.

While the teacher is central in the traditional curriculum, as a repository of information which is to be passed on to students, in problem-based learning the student is stimulated to actively search for knowledge while the teacher assumes the role of a tutor. The learning process

starts with a clinical problem related to a major theme in the curriculum, simulating a real situation which is going to be encountered in practice, with more complex basic science, social and ethical implications. A small group of students then work together to first recall the knowledge they have on the matter and then to identify the knowledge they require in order to solve the problem. They allocate tasks to each participant, regarding the retrieval of the necessary information. The group meets again after a few days to impart to all members the new information they acquired on the matter and to apply it in the process of finding a solution. The role of the tutor is to direct the enquiring and thinking process, without actually presenting any professional data (Wood 2003, Schmidt 1983).

Problem-based learning has its theoretical underpinning well defined within the modern theory of education. Four principles serve as foundation for the method:
i) learning is a constructive process; ii) it should be self-directed; iii) it should be social and collaborative; and iv) it should be embedded in a context (Thurley 2008).

The constructivist theory of learning maintains that new knowledge is integrated through the learner's distinct cognitive processes and its meaning is allocated within the pre-existing system of concepts of the individual. Recall of previous knowledge when confronted with a new problem, as it is practised in problem-based learning, will facilitate the assimilation of the new information required in order to solve the problem. Constructivism also emphasises the importance of the student being actively involved in the learning process. By taking responsibility for their learning, students will develop internal motivations for autonomous study (Williams 1999). Constructivist models of learning stress the importance of collaborative learning in order to arrive at a shared understanding of the truth in a specific field. Collaboration leads to better problem-solving than competitive learning (Qin 1995). Finally, learning in a context that is similar to situations which are encountered in medical practice will facilitate the recall of the necessary information when facing those situations in reality (Tileston 2005:42).

The formal assessment of the student's performance needs to be modified to reflect the new context of learning. Formative assessments can be done on the performance of the student in the process of problem-solving, within his/her group. Summative assessments may target not only the knowledge acquired, but also the degree of mastering of the technique of problem-

based learning, as a skill that will be used later in the future doctor's continuing medical education process.

The advantages and disadvantages of the problem-based approach to learning have been scrutinized by many authors. Here is a succinct summary: major advantages concern the active learning which improves understanding and retention; it also sets the foundation for life-long learning skills. Generic skills and attitudes useful in future practice, such as identifying problems, retrieving and assessing information, communication and group working are being developed by problem-based learning. The curriculum can be integrated, to the extent that solving problems involves basic science, ethics, pharmacology and other areas of medical science. Contextual learning is conducive to deeper learning. Last, but not least, problem-based learning is fun for both students and tutors. Disadvantages are related to the longer time required by the process and the need to re-train the staff in the techniques of problem-based curricula. More staff may be needed, given that the work takes place in small groups of six to eight students. The library should be equipped to allow more students to use the same resources simultaneously. At times, the limited function of tutor assumed by the teaching professional may deprive the students of the role models they need in order to mould their own personalities. On the other hand, tutors may find that the impossibility of passing on their knowledge and understanding of phenomena may be frustrating (Wood 2003, Thurley 2008).

Contrasting with the obvious enthusiasm with which problem-based learning is regarded in many institutions of higher learning, medical or non-medical, is the lack of overwhelming evidence that it contributes to producing superior professionals. The students' performance in the standard United States Licensing Examination Step I and II (Basic Sciences and Clinical Sciences) at the University of Missouri Columbia School of Medicine were found, however, to have improved from below average national scores to above average after the introduction of the problem-based curriculum (Blake 2000). A recent systematic review was done, of the literature published from the inception of problem-based learning to October 2006, seeking to compare the attributes, self-reported and observed, of medical practitioners educated in a problem-based curriculum versus those coming from a traditional curriculum. Doctors educated in problem-based curricula were found to score higher, both on the subjective and objective scale, for coping with uncertainty; appreciation of legal and ethical aspects of health care; communication skills; and self-directed continuing learning. It is important to note that

the other elements of professional competence appeared to be comparable in the two groups (Koh 2008).

2.6.5 Information technology

The widespread use of personal computers and of the Internet opened new possibilities to enhance teaching and learning. It provided teachers with the ease of use of multimedia presentations, in order to illustrate lectures and make their content more informative, achieving at the same time a significant impact on the attention of the learners and retention of information. On the learner side, these tools opened access to electronic learning resources such as journals and textbooks in e-libraries. Telemedicine and teleconferencing enhanced the content of postgraduate and continuing medical education.

The systematic use of the resources mentioned above in programs of e-learning is widespread. Within such a program, the learners can take an initial test in order to identify the lacunae or weak points in their knowledge. The system provides individualised plans of study and suggests several learning methods: discussion group, e-library, expert session or practice assignment. Thereafter, by accessing these learning resources, usually available via the Internet, from the place and at a time of their choice, they can complement the information obtained from lectures and textbooks. At the end of the prescribed program, they can take a mock test. The program compiles an individual report of progress attained and makes future recommendations for study (Amin 2003:348).

An advantage of e-learning is the possibility of structuring the material in "learning objects". These subunits may contain, for example, besides content, a short description of the material, learning objectives, assessment plan and links. The content itself can be broken into separate learning objects like physiology and pathophysiology, anatomical pathology, etiology of the disease studied, and so on. The advantage of learning objects is that they may be contributed by different teachers, they can be updated separately, and they are shareable between various subjects and even between various disciplines (Ruiz 2006).

Another technological impact on learning and patient care is represented by the widespread use of hand-held computers. They offer instant access, from almost any location, to information available on networks or on the Internet. They are extensively used, mainly for accessing textbooks and information on medicine. Various medical calculators are also in use, but they are suitable for numerous other applications (Kho 2006).

E-learning makes it possible to structure the learning around the student rather than the classroom. An individual learning plan optimises the learner's efforts. It also makes continuing medical education much easier, by virtue of the characteristics above, but also due to the flexibility of time and place of access.

2.7 The undergraduate haematology curriculum

Worldwide until now, little information has been published regarding the competencies to be taught and outcomes to be attained in an undergraduate haematology curriculum. It is only recently that a survey of medical schools in the United States of America, initiated at the University of Washington in Seattle (Broudy 2007) has given some evidence about the way haematology is being taught. The analysed data cover 58 courses held in 57 faculties across the country. The duration of the courses surprisingly varied from 4 hours to 73 hours (although all students are obliged to take a standard national examination, the United States Medical Licensing Examination Part I, which requires them to have the same level of knowledge). The content also varied, from physiology and physiopathology to pharmacology and palliative care. Thirty-eight courses out of 58 were also teaching oncology; almost all (more than 90%) taught the identification of anomalies in the peripheral blood smear.

The methods used across the United States to train undergraduates consisted mainly of lectures (median time allocated was 50%), small group case discussions, patient interviews in front of the class, web-based teaching and journal club. Problem-based learning was the main method of only one course. Fewer than 20% of the courses offered laboratory sessions during which the students were taught to determine a haematocrit, to prepare peripheral blood smears, to do ABO and Rh typing and to evaluate anomalies using microscopes and blood slides.

A significant, positive feature of most of the programmes was the patient-centred learning, consisting of patient interviews in front of the class, case discussions, problem-based learning and reflection on the meaning of caring for patients with haematological malignancies. There was a lack of clarity, however, on the core learning objectives of the haematology course; many respondents in the survey, for instance, did not know whether haematologists or pharmacologists were the ones supposed to teach the mechanisms of action of the chemotherapy agents.

The survey found that the Internet-based teaching programmes were becoming increasingly used and cautioned against the resulting severe intrusion into student time and a lack of student-faculty contact, which prevents the student from learning from models of professional behaviour. Finally, the study suggested that a national effort should be made to define learning objectives for haematology courses and to share teaching materials among medical schools.

This survey is the first and only attempt to evaluate undergraduate training in haematology at a national scale, in a resource-rich country. The curricula in the United States, as everywhere in the world, are designed by faculty members, and they are not necessarily adequate, as revealed in the study. Financial limitations, coupled with a diminishing interest among faculty in teaching, as it is not academically rewarded, were identified as further hurdles in the path of effective teaching of haematology.

A few other studies disseminated over the last 30 to 40 years either reflect personal opinions on training in haematology, which do not go beyond the general principles of adult learning (Davidson 1970, Emerson 1991) or reports resulting from using particular teaching methods such as computer-assisted training or problem-based learning (Garrett 1987, Wood 1998, Casassus 1999, Riley 2002, Kraemer 2005).

The literature on the skills required in general practice in order to manage haematology cases satisfactorily does not offer a comprehensive inventory. Only a few aspects have attracted the interest of the researchers. To start with, the need for skills in the domain of preventive medicine was highlighted, mainly with regard to haematological cancer prevention and early detection (Mahon 2000; Meyskens 2005). Another area of prevention that has been discussed is iron deficiency in children (Ahluwalia 2002). The generalist is part of the integrated care of patients with haematological malignancies, providing either follow-up after treatment (Prasad 2008, Léger 2004, McGrath 2007) or palliative care, and the management of pain is paramount in this context (Zernikow 2008). The monitoring of chronic anticoagulation, for example in patients with atrial fibrillation, can be done best in conjunction with point-of-care testing (Rose 1998). The skills related to point-of-care testing are highlighted as important for both developed and developing countries, as they circumvent the need for expensive laboratory work (Briggs 2008; Huisman 2007). Such skills encompass haemoglobin determination, anticoagulant activity assessment and fine needle aspiration.

Further skills are required in the management of anaemias, which are by far the most frequent type of haematological pathology seen in general practice. Flow charts were composed to assist generalists with the diagnosing of anaemia (Huisman 2007). It is obvious from the analysis of the literature that, while offering important insights on the required haematological skills in general practice, the published data do not cover the extent required for designing a curriculum in haematology.

The American Society of Hematology offers a detailed curriculum on its website, which underlines the importance of evidence-based outcomes and of including the values of patients and physicians, clinical experience and scientific evidence in the daily decisions of the medical practice. However, this document applies only to postgraduate specialisation in haematology and therefore its depth and extent are far beyond the boundaries of a basic haematology course. Also, the process followed in designing this curriculum and the ways of periodically assessing its relevance have not been stated (American Society of Hematology 2008). Similarly, the European Hematology Association is developing a pan-European curriculum/passport for specialist training, which will be recognised in the whole of the European Union. In South Africa, the undergraduate curricula in haematology are designed by the faculties of health while the subspecialty of curriculum development is the prerogative of The College of Medicine. Again, the process of curricular design is not publicised.

2.8 Summary of the literature review

The recurrence or permanence of certain facts in the history of education allows the delimitation of several concepts of which one should be aware in the process of curriculum planning:

- Education is a result of socialisation: social life makes possible education by transmitting information between generations inside the social group. At the same time, education ensures the permanence of the group, with the young generations taking over the social and economic roles of the old ones. Societal needs must, of necessity, inform the curricula of education institutions, including medical schools.

- Another consequence of this need is the increasing supervisory role of the political and administrative authorities on education throughout history. Nowadays, every curriculum is planned in accordance with the standards set by regulatory bodies with

a social mission, lest the accreditation of the educational institution be lost and its students not be able to pass licensing exams such as matriculation or, at another level, for example, the United States Medical Licensing Examination.

- The content of education is conditioned by the extent of the knowledge accumulated in the society. In the middle of the present scientific revolution, knowledge evolves faster than ever before and curricular content needs to be updated frequently.

- Teaching methods are dictated by content, but must take into account the psychological processes of learning for optimal results. Comenius (see above) is certainly one of the pioneers of this concept; the knowledge on the mental processes of learning is far from complete even in our times.

- Historically, education always required the presence and guidance of a teacher who knows the domain that is taught. Problem-based learning, for instance, while stimulating the learners to discover the matter to be learned themselves, probably cannot do away with the guidance of someone who knows the matter well.

- Language is the main vehicle of knowledge; therefore it has to be mastered at an appropriate level. This occurs only when it is shared and practised by everyone in their daily life. Latin was abandoned because it hindered the transmission of information: not being used in daily life, it did not evolve to fulfil the needs of education.

- The invention of printing with mobile type revolutionised education by providing mass dissemination of information; the same can be said of today's Internet. Its intensive use is raising the quality of education to another level.

- The multitude of currents of ideas around curriculum development in the last century was born out of a need to adapt curriculum design to the more rapid rate of change of science, technology and society. The fundamental building blocks of the curriculum remain unchanged: a comprehensive needs analysis, content, teaching methods, assessment of learners, and curriculum evaluation. Programmes in higher scientific and technical education are mainly developed along the principles of scientific curriculum building.

In considering medical curriculum development, a few fundamental features are derived from the literature:

- Training in medicine has always included substantial contact with patients, from the earliest times to the present. Patients cannot be replaced by lectures and, for the foreseeable future, not by any electronic substitute. Working with patients imply working under supervision of a qualified doctor, hence the continuing role of the mentor in medical education.

- The same strong supervisory role of the political and administrative entities as seen in education in general, is seen in medical education.

- If working with patients is an essential component of medical education, the understanding of the basic sciences such as anatomy, histology, physiology and pathophysiologyphysiopathology, biophysics and biochemistry, etc. is just as essential. Modern medical education, as envisaged by Abraham Flexner at the beginning of the 20th century, relies on bringing these components together under the same roof as clinical teaching. Moreover, the permanent reinforcing of the connections between clinical findings and preclinical knowledge fosters the understanding of various manifestations of the same disease and guides the management thereof.

- The Johns Hopkins group, under the leadership of Kern, has conceptualised medical curriculum design by following the principles of scientific curriculum building and has developed a protocol that is practical and widely accepted. Their design in six steps includes: general situation analysis; evaluation of learner needs; formulation of goals and objectives; choice of educational strategies; implementation and evaluation of learners; and feedback.

- Central to curriculum building, as envisaged by the Johns Hopkins group, is the general needs analysis and the assessment of the learners' needs, which informs the other steps.

- Alternative medicine is a reality and medical graduates need to be aware of it, even integrate some of its elements in their approach to disease. Problem-based learning and information technology-enhanced methods of teaching and learning are valuable tools for passing on information and should be included in the planning of curricula.

The following chapter details the methodology used to conduct the needs analysis for the haematology curriculum. The opinions of a number of groups of stakeholders in the curriculum were surveyed by means of open-ended questionnaires and by means of the Delphi method. A list of the content items was generated and these were then rated by the panellists according to their importance for the general practice. The results were compared with the existing curriculum in haematology.

Chapter 3

RESEARCH METHODOLOGY

Whether you can observe a thing or not depends on the theory which you use. It is the theory which decides what can be observed. A. Einstein

3.1 Introduction

The aim of this study was to construct a framework for developing an undergraduate curriculum in haematology, based on broad consultation with the participants in the educational process, including teachers, trainees, graduates at various career stages and specialist haematologists not affiliated with the training programme. The research questions are restated at the onset of this section, as a starting point for the description of the methodology used in search of the answers. The chapter continues with a characterisation of the groups of "stakeholders" in the haematology curriculum, as enumerated above. A justification of their selection for the study will be given, in order to demonstrate that data were elicited from suitable sources. Following that, an account of the methods used for collecting the data and for analysing them, will be given here. The characteristics of these methods will be discussed, with emphasis on their reliability and validity, which define their accuracy in reflecting the studied phenomena. The advantages, as well as the limits of the chosen research tools will be discussed, relying on the literature on research methodology. Further to this, the research design will be discussed. Due consideration will be given to the general framework of philosophical concepts within which this research evolves: its underlying paradigm and epistemology.

3.2 Research questions

The central question addressed in this research is: ***What changes should be made to the existing undergraduate curriculum in haematology at the Faculty of Health Sciences, University of Stellenbosch, in order to make it relevant to the needs of the general practitioners?***

The answer to this central question can only be formulated on the basis of the facts acquired in the process of responding to the following:

- What elements of knowledge and skills are required for efficiently managing haematology patients in general practice?

- What is the hierarchy of importance of the above elements for the generalist practice? The term "importance" is used here to designate the frequency with which the element of knowledge or the skill is used and the impact it makes on the outcome of the patient. For instance, blood transfusion is a rare therapeutic skill but may be life-saving, thus important. Also important is the interpretation of a full blood count result, which is not as dramatically life-saving but is a frequently used skill.

An additional question addresses ***the value (advantages and limitations) of the Delphi method in surveying the stakeholders in the curriculum*** for their opinions on the two issues formulated above. Delphi is only one of the methods proposed by Kern and collaborators for performing a survey of curriculum stakeholders, but it is the easiest and least costly to perform. This study will look at the potential of the Delphi method to offer adequate answers for curriculum development, with the aim of establishing whether it can be used for this type of survey on its own, or whether it needs to be complemented by other methods.

3.3 Data source: groups of participants in the curriculum

The general approach to curriculum development at the Faculty of Health, University of Stellenbosch, is that each discipline develops its own teaching plan. The participation in the process of a general practitioner, to provide a complementary perspective, is recommended (Stellenbosch University, 1997). This process, however, does not offer a platform from which the voices of the other professionals who graduated from the course and have progressed to applying the acquired knowledge of haematology and specific skills in their daily work can be heard. The collective opinion of these professionals on the usefulness of the syllabus for everyday generalist practice might differ from that of a single practitioner. There is no student input either, although the students are in the best position to appreciate the proper way in which the haematology course connects with the knowledge they accumulated prior to entering it. They also can provide information on the impact of the teaching methods in the programme on the outcome of their training.

The premise of this study is that broad consultation with the stakeholders in the haematology training process, including past graduates who are already in practice, would generate a more appropriate assessment of the relative importance of the various items taught in the haematology programme at the Faculty of Health, University of Stellenbosch. To this purpose, the opinions of various categories of participants in the training process, as well as the opinions of general practitioners, on the relative value in medical practice of the components of the syllabus in the discipline of haematology, were sought.

In order to obtain a balanced perspective, the following groups of professionals and students were invited to participate: twenty general practitioners, five adult haematologists, ten paediatric haematologists, four laboratory haematologists, ten interns and fourteen sixth-year students. With the exception of paediatric haematologists, who were practicing in various places across South Africa, the other participants were all working in the Western Cape. All the haematologists were employed in tertiary academic institutions; one of them was part-time in private practice. The main selection criterion for the trainees, interns and general practitioners was present or past undergraduate training in haematology at the Faculty of Health Sciences, University of Stellenbosch. The second criterion was that their work should require them to take diagnostic and therapeutic decisions in haematological diseases. No further sampling criteria were applied; Murphy (1988), in his comprehensive review of consensus development methods used in developing clinical guidelines, found that, once the decisions on the professional groups to be surveyed are made, the selection of the individuals has very little influence on the results.

In the absence of clear guidelines from the literature, the size of the panels consulted remained to be dictated by the availability of participants in a given group and by the available time and resources. Further considerations related to the selection of experts are presented in 3.5.1.

3.4 Data triangulation

The requirement of triangulation was satisfied by eliciting opinions from groups of professionals variously positioned with respect to the curriculum: teachers, students, haematologists not directly involved in the haematology course, recent graduates and past graduates. Triangulation in research postulates that arriving at the same results by different

paths would strengthen the validity of the findings. Thurmond (2001) reviewed the literature on the subject and identified several accepted modalities of achieving it: "…the combination of two or more data sources, investigators, methodologic approaches, theoretical perspectives or analytical methods within the same study" are all suitable for the purpose. Such methods may be used alone or in combination (multiple triangulation). Denzin (1970, in Bryman 2002), described data triangulation as gathering of data through several sampling strategies, so that slices of data from different times and social situations, as well as on a variety of people, are gathered.

While the concept of triangulation seems straightforward, a thorough dissection of it would reveal surprising aspects. These mainly revolve around exactly what the meaning of arriving at (or converging towards) the same results by different approaches is: is this a proof that the study has indeed found and depicted a reality that exists outside of and independent of the researcher and her/his methods? The adepts of an objectivist epistemology would answer positively, while partisans of the constructivist or subjectivist thinking systems would be quick to point out that a successful triangulation is only a "…*process* whereby the researcher earns the confidence of the reader that she or he have 'gotten it right'. Trustworthiness takes the place of truth" (Hesse-Biber & Leavy 2006:66).

Another element of caution when evaluating whether triangulation adds to the validity of the findings of a study relates to the proper selection and use of methods: by using flawed methods, or by applying methods in an incorrect manner, it is possible to arrive at similar results, but the study would remain flawed (Thurmond 2001).

3.5 Method chosen to generate data

The optimal way of determining the content of a curriculum is to use an evidence-based approach. In the absence of evidence, it is necessary to use opinion-based processes to decide on curriculum content. One advantage of opinion-based processes is that they can involve various groups of "consumers": learners at different stages of the learning process, general practitioners, and even patients. The results, however, depend on who takes part.

In this study, the process of determining the core haematology requirements consisted of initially developing a list of subjects and skills to be taught and subsequently using a Delphi

method of interaction between the participants in the study to determine the order of importance of various components of the syllabus.

3.5.1 Definition and history of the Delphi method

The Delphi method is a technique for eliciting suitable information for decision making, based on the opinions of a group of experts. It is based on a structured process for collecting and synthesising knowledge from a group of experts by means of a series of questionnaires accompanied by controlled opinion feedback (Adler & Ziglio 1996). The method was developed at the RAND Corporation in California, USA in the 1950s by Olaf Helmer and Norman Dalkey, originally as a means of forecasting events in the military domain. Its name was inspired by the oracle at the temple of Apollo in Delphi, where, in the times of ancient Greece, people would arrive from distant places to seek answers about their future.

The Delphi method's underlying philosophical concept is that, in fields of knowledge which have not yet developed to the point of having scientific laws, the opinion of the experts is admissible in order to circumscribe the reality (the philosophical underpinning of the method is described extensively in Linstone and Turoff, 2002). Our understanding of reality is seen as a spectrum of degrees of accuracy. At one end of it is the knowledge: it is thoroughly supported by solid evidence, usually obtained by the scientific method. At the other end, little or no available evidence leaves the ground open for speculation. The segment of spectrum situated between the extremes is the realm of wisdom, or insight, or informed judgment. This is where Delphi may be used in order to optimise the information than can be extracted from such wisdom (Dalkey in Adler & Ziglio, 1996:6)

However, the judgment of single experts may be biased and group meetings develop patterns of interactions between participants such as "follow the leader" behaviours or reluctance to abandon previously stated opinions in order not to lose status within the group. To avoid such events, the Delphi method uses mailed or e-mailed questionnaires, thus ensuring the anonymity of the panellists, controlled feedback and statistical response.

3.5.2 Description of the Delphi method

The following ten steps characterise the method (The Delphi Method 2008):

- Formation of a team to undertake and monitor a Delphi on a given subject.
- Selection of one or more panels to participate in the exercise. Customarily, the panellists are experts in the area to be investigated.
- Development of the first round Delphi questionnaire
- Testing the questionnaire for proper wording (e.g., ambiguities, vagueness)
- Transmission of the first questionnaires to the panellists
- Analysis of the first round responses
- Preparation of the second round questionnaires (and possible testing)
- Transmission of the second round questionnaires to the panellists
- Analysis of the second round responses (Steps 7 to 9 are reiterated as long as desired or necessary to achieve stability in the results.)
- Preparation of a report by the analysis team to present the conclusions of the exercise.

The proper selection of panellists requires a clear definition of who is an expert for the purpose of the survey. Here, the most important attribute is not the academic proficiency (which indeed may be required for specific applications) but rather knowledge of and practical involvement with the issues under investigation. An inadequate selection of the panel will lead to meaningless answers.

Delbecq, Van de Ven and Gustavson (1975) define three groups of people who are well qualified to be subjects of Delphi:

"(1) the top management decision makers who will utilize the outcome of the Delphi study;

(2) the professional staff members together with their support team; and

(3) the respondents to the Delphi questionnaire whose judgments are being sought"

The size of the panel does have an influence on the results. If, for instance, it consists of a homogeneous group of experts, 10 to 15 participants would be enough. On the contrary, if various reference groups are involved, the panel must be much larger. Dalkey has shown that the size of the group influences the accuracy of the results up to a certain point. Beyond that point, however, there is very little to gain, in terms of result precision, from widening the group (Linstone & Turoff 2002:224-230). There are, however, no precise guidelines or mathematical formulas for calculating the size of the panel: experiments by Brockhoff (in Linstone & Turoff 2002:287) suggest that, under ideal circumstances, groups as small as four can perform well, while "five to 20 experts with disparate domains of knowledge" would be enough for Rowe and Wright (2002:125).

The survey should be stopped when arriving at consensus among participants or, in the absence of consensus, when stability is attained. Consensus is understood as a "general agreement" in constructing a hierarchy and making judgments (Hanafin 2004). Stability is defined as no change (or very little) from the previous survey. When setting up Delphi rankings, the mean value is most often used to indicate the opinion of the panel and the standard deviation to measure the strength of the opinion for a given item. This approach has been criticised and Kendall's coefficient of concordance was proposed as a better measure of agreement (Schmidt 1997).

A number of variants have emerged from the numerous studies where Delphi was used. The "Classical Delphi" is characterised by the following features: anonymity, iteration, controlled feedback, statistical group response and stability in responses at the end of the exercise. The "Policy Delphi" is used to generate policy alternatives by means of a structured public dialogue. Its aim is to identify divergent opinions rather than consensus. The anonymity in this method may be selective, i.e. although the participants answer the questions individually, they may be allowed to participate in a group meeting. The "Decision Delphi" is used for forming decisions on social developments. Here the decision makers are the participants in the survey; the aim of the process is to attain consensus. Such an exercise operates in "quasi-anonymity": while the participants are known by name, their answers are anonymous (Hanafin 2004:5-6).

From these descriptions, the final aim of a Delphi technique appears clearly to be that of obtaining a collective answer to the question asked, with facilitated consensus. Should answers indicate divergence in opinions, the authors should explain their views and these

explanations should be analysed. Both consensus and dissension are valuable and should be explored with regard to their reasons and to their significance towards the solution sought in the research.

The method has been applied in almost one thousand studies worldwide, involving panels of various sizes, for evaluating phenomena (and especially predicting their course) in the industrial, military, economic and social fields (Gupta & Clarke 1996; Landeta 2006).

3.5.3 Aspects of using Delphi in the design of medical curricula

Delphi was chosen by numerous teams of researchers worldwide for surveying expert opinions in the process of designing medical studies curricula. It was used, for example, for determining the content of core undergraduate psychiatry (Wilson 2007); to identify the priorities to be met by a family medicine training programme (Kanashiro 2007); to obtain the students' perspectives on a radiology curriculum (Subramaniam 2006); for involving patients in curriculum development (Alahlafi & Burge 2005) and in many other studies. The method was found to be suitable for determining the outcomes (Clayton 2006), the contents (Carley 2006; Kilroy 2006) and the methods of teaching (Fallon 2006) for various medical programmes.

All studies consisted essentially of a list of items such as outcomes, skills, course topics or teaching methods, which was submitted for rating of importance (this meaning mainly usefulness for medical practice) to a panel of experts. The list might have been formulated by the authors, obtained from other curricular documents or drawn up by a group of experts specifically tasked to design it. Sometimes the list was based on interviews or free text questionnaires answered by the same panels of experts who would be asked to do the ratings. The responses to such instruments were analysed by means of the coding method, and may have been combined or not with other sources from literature in order to compile the list of curricular components whose rating was sought.

As outlined above in 3.5.2, the expertise of a panel member was generally not related to the academic status but to the experience regarding the subject under study. For instance, a student may be an expert whose opinion on the impact of a number of teaching methods being studied may be sought on the basis of the student's direct experience of the effects of

such methods (Miflin 1999). Nevertheless, in curriculum-related matters, most studies mostly sought the opinions of professional authorities in the respective domains.

After each iteration, data were analysed as indicated above in 3.5.2 and feedback was given to the panellists. The final results were used in the process of drawing up curricula in the respective domains. It is important to note here that the Delphi survey result *is not* the curriculum, not even the syllabus, but is used by the curriculum committee in order to ensure the relevance of the training programme for the future professional practice of the group of targeted learners.

3.5.4 Advantages of using Delphi

The main advantage of the method is that of circumventing the common biases which arise from group interaction: influence of dominant individuals, group pressure for conformity and noise (i.e. loss of focus and drifting from the issues studied, whether due or not to individuals or sub-groups trying to push their own agendas) (Dalkey, in Hsu 2007). This is achieved by suppressing direct contact between the panellists, giving anonymous feedback with the iterations and ensuring confidentiality. A second, not less important advantage is that of fostering consensus among the panellists, which increases the validity of the results. Further benefits are related to the reduced time constraints for the participants: the respondents can choose the proper moment to work on the questionnaire. Considering and re-considering the same issues, in the light of the offered feed-back, constitutes a stimulus for in-depth thinking. The controlled feed-back and anonymity enable panellists to revise their opinions without publicly admitting to doing so, and this encourages them to take a personal viewpoint rather than a more cautious public position (Gupta 1996). Furthermore, the method gives the possibility of addressing experts in largely distant geographical locations, by means of e-mail.

3.5.5 Disadvantages of using Delphi

A major indication for resorting to Delphi is forecasting, and this is at the same time a great cause for criticism of the method, as many feel that predicting the future is an act of high importance and should not be entrusted to a technique which has no connection with the scientific method or with mathematical formulas. Other criticisms highlighted the

vulnerability of the method to "...conceptual and methodological inadequacies, potential for sloppy execution, crudely designed questionnaires, poor choice of experts, unreliable result analysis, limited value of feedback and consensus, and instability of responses among consecutive Delphi rounds" (Gupta in Hanafin 2004:40). The answer to these critics is that poor implementation of a technique should not be seen as a disadvantage of the technique itself, but rather as a proof of the inability of those who use it. "There is no reason why the Delphi method should be less methodologically robust than techniques such as interviewing, case study analysis or behavioral simulations, which are now widely accepted as tools for policy analysis and the generation of ideas and scenarios" (Adler & Ziglio1996:13)

Another disadvantage arises from the unclear distinction between who may be an expert or a layman with respect to the issues studied, and lack of sufficient evidence that the opinions of experts are more reliable than those of laymen (Gupta 1996).

Further disadvantages of the proposed method are mainly related to the requirement for a meticulous preparation of the questionnaires, which should be formulated without any ambiguity; another critical area is the judicious choice of the participants. A frequently mentioned further difficulty is the long time required to implement it, which typically is three months for a three-round Delphi survey.

It is easy to assume that the content of the feedback would exert a major influence on that of the answers. A potential for moulding the opinions of the respondents exists here and, indeed, a number of experiments have shown that participants in Delphi would rate their subjects differently after receiving distorted feedback (Hsu 2007, Hanafin 2004).

3.5.6 Arguments for the choice of method

The data in this study consist of specialists' opinions on the items to be included in a haematology syllabus and on their relative importance. Suitable techniques for data collection from people, which may be used in such studies include: interviews, focus group discussions and written questionnaires (Varkevisser 2003). Interviews present the advantage of being suitable for a large range of subjects, even illiterate; they permit clarification of questions and answers; they would allow for unexpected aspects of the researched problem to surface and be explored and usually have a higher response rate than written questionnaires. On the other hand, they are time-consuming and relatively costly and this limits the number of

participants; should a large number of participants be required by the study, the interview would need to be more structured in order to ensure optimal use of the time – it then rather resembles a questionnaire; the presence of the interviewer may influence the respondents, either by possibly directing the answers or simply by involuntarily suggesting that a certain conduct or personal image may be more appropriate for the interviewed. Due to the number of participants in this research and to the fact that the questions asked had to be structured around a list of topics forming the curriculum, the interview technique was not suitable in this case.

Focus group discussions were considered for their advantages: allowing capturing multiple opinions simultaneously on the same matter and thus becoming aware of the various facets of the issue studied; also, the interaction between members may be stimulating and contribute to the flux of ideas. Again, due to the number of participants, focus group discussions would have required a large investment of time. The geographical distribution of the locations of various specialists included in the study would have made it rather difficult to assemble them for the purpose of discussions. The dynamics of focus groups discussed above, i.e. the influence of dominant individuals, peer pressure to conform and noise, would have added to the difficulty of conducting successful discussions.

The questionnaire – self-administered – would have been more suitable, and in fact the Delphi method uses questionnaires. They are less expensive; by providing anonymity they may elicit more honest responses; the possible bias, sometimes induced by rephrasing the question during interviews, is eliminated. However, questions may be misunderstood and it is easy for the subjects to neglect responding. A large number of drop-outs from a questionnaire study introduce a bias which cannot be compensated for, as their possible responses can not be known or guessed.

While Delphi uses questionnaires, it also allows for a more in-depth reflection on the issues, due to the iterations; by offering controlled feed-back, it paves the way for consensus, eliminating the noxious focus group interactions. All other advantages of the questionnaire method are preserved with Delphi. Moreover, by scaling using Likert items to categorise the respondents' opinions, it becomes possible to apply simple mathematical analysis in order to evaluate more precisely the degree of consensus between the participants, on a certain item.

A final argument is that the method has already been used successfully for curriculum development and has gained recognition for this type of application (Linstone & Turoff 2002).

3.5.7 Issues of reliability and validity

As the Delphi method elicits and analyses only the opinions of the panellists, the degree of expertise or familiarity with the researched problem relates to the validity of the results. In this study, all panellists were connected to the haematology curriculum, either as teachers or haematologists, or as former learners.

Another issue related to the validity of the results is whether the convergence/consensus attained is indicative of the correct value that counts. Dalkey (1969) has shown that, statistically, the convergence obtained by the method is in the direction of the true value. By using almanac-type questions within a Delphi method administered to graduate students at the University of California – Los Angeles –, ("… who did not know the answers but had some relevant knowledge") he was able to ascertain that, for a high level of confidence in the answer given and a low dispersion of the answers (consensus), the results of the Delphi method were at a close range of the real answer.

The average error of the answers decreased with the increase in size of the group, with a reduction of approximately 50% for groups counting seven members. From there, the rate of decrease of the error diminished at a smaller rate; for instance, adding another 20 members to the group only reduced the error by an additional 10%. The degree of consensus was shown to increase after each iteration, but the maximal increase occurred at the first iteration; with further rounds the progress towards consensus was much slower. The accuracy of the answers increased, similarly to the degree of consensus, mainly with the first iteration, and afterwards was fluctuating.

Tests of the reliability of the method are difficult to perform. Gupta (1996) indicates why: in order to determine that the answers reflect the true judgments of value of the panellists on the issues studied, a large number of repetitions of each test needs to be administered, which is not consistent with the nature of the Delphi.

3.6 Research design

This study was designed as a non-experimental, descriptive survey, using the Delphi method. As shown above, Delphi is an iterative mailed survey (e-mailed in this case) where, with every iteration, the participants receive statistical feedback from the previous phase and are invited to re-consider their answer in the light of that feedback; by modifying their answers the participants are moving towards consensus, as far as, based on personal expertise, they still consider their answer to be correct. The opinions of the participants are usually measured by means of a Likert scale and the measurement result serves to derive the statistical feedback.

The aim of the survey was to obtain the opinions of the participants on the knowledge and skills required for the practice of haematology at generalist level. To this effect, a list of topics and skills was drawn up for rating by the panellists according to the importance of each topic for practice. In order to help develop the list, the Delphi was preceded by an open-ended questionnaire in which those surveyed were invited to list the knowledge and skills required when managing haematology cases in their practice. Their answers were then combined with the list of topics in the existing haematology curriculum.

The data obtained in this way were compared with the existing curriculum in haematology and changes were identified which would bring the training in line with the requirements of generalist practice.

The hybrid character of the Delphi method, as described above, is obvious to its users (Stewart, 2001). The combination of open-ended questionnaire followed by iterative survey with statistical feedback corresponds with what Creswell (2009:211) describes as a type of mixed method which he names *sequential exploratory strategy*: "a first phase of qualitative data collection and analysis, followed by a second phase of data collection and analysis that *builds* on the results of the first qualitative phase".

At the first stage, of the open questionnaire, Delphi returns qualitative data which may be submitted to an interpretative analysis. Ritchie and Lewis (2003:3), analysing multiple published definitions of qualitative research, conclude that "… there is fairly wide consensus that qualitative research is a naturalistic, interpretative approach concerned with understanding the meanings which people attach to phenomena (actions, decisions, beliefs, values, etc) within their social worlds". They go on to identify other distinctive factors of

qualitative research, in the area of methodology, as they appear in literature: "the overall research perspective and the importance of the participants' frames of reference; the flexible nature of the research design; the volume and richness of the qualitative data; the distinctive approaches to analysis and interpretation and the kind of outputs that derive from qualitative research". The usual methods of qualitative research are also identified: observation, in-depth interviews, group discussions, narratives and analysis of documents, questionnaires.

In the second stage, that of the Delphi iterative survey, the study uses a modified form of self-administered questionnaire, where iterative steps containing statistical feedback from the other participants are included. The participants' statements are not analysed for meaning but are grouped together on the basis of similitude and reported as "consensus". The use of scaling (mostly of the type of a Likert scale) makes possible a quantitative, statistic evaluation of the convergence and dispersion of the opinions. However, the mathematical instruments are there only to give an estimation of the degree of consensus. The meaning of the findings is not extracted from statistics but from the processed opinions of the participants.

3.7 Research procedure

The various groups of subjects were selected according to the criteria outlined in 3.1. An introductory letter was sent to the participants (see Addendum p.157), by which the researcher introduced herself and then explained the purpose and the methodology of the study. This letter was accompanied by a short consent form and by a first open-ended questionnaire, through which the participants were invited: a) to list the skills required in the management of haematological patients in their practice and b) to suggest topics for inclusion in – or exclusion from – the curriculum, based on their own experience (Addendum pp.159-161. The answers were analysed using coding and extracting the main themes (Creswell 2009:188).

On the basis of the proposals from the open questionnaires, a list of outcomes was compiled and it was then compared with those proposed in the existing curriculum. Using the proposed topics and including those already existing in the haematology syllabus, a list of suggested topics was assembled. An accompanying letter was drawn up (Addendum p.162) by which the panellists were invited to rate the importance of the topics on a Likert scale ranging from

one to four: 1 – strongly disagree; 2 – disagree; 3 – agree; 4 – strongly agree. The rating had to be based on the usefulness of the topic for medical practice, according to the participant's opinion. The scale was chosen in such a way that an undecided "middle" option was not possible. Both letter and list were verified for clarity by running a pilot test on five general practitioners and asking for their feedback. A few minor changes were made following their suggestions. Then the first Delphi phase was launched by sending these two items to the panellists.

The answers were analysed in order to determine the consensus among participants on the value of the items. This was defined as the event where a minimum of 80% of the participants ascribed the same rating to a given item. A new list was then drawn up, excluding those items on which consensus had already been attained; this list also showed the distribution of votes, in percentages, for each rating regarding every item. This new list thus informed the participants of the opinion of the other panellists. In the accompanying letter, the specialists surveyed were offered the option to review their position on the significance of the items listed and, if their opinion had changed, to re-rate them (Addendum p.167-168).

The new ratings were again analysed for consensus and the process was repeated one last time, following the same procedure as described above (Addendum p.169-170). These last results were analysed along the same lines. The resulting rating was then interpreted and the conclusions for the curriculum were formulated.

All correspondence was carried by e-mail or by personally handing the letters and forms to the panellists.

The data thus obtained were then analysed for meaning and compared with the existing syllabus. Reflection took place on the importance of ratings allocated to syllabus subjects for the general structure of the curriculum. The findings were used to make proposals towards a framework for curriculum development in haematology.

3.8 Ethical considerations

Subjects who participate in biomedical research may be harmed physically or mentally. Negligence may also cause damage to their social and familial status. The most notorious cases of extreme abuse of subjects during research came to light during the Nuremberg trial

where the atrocious "experiments" on prisoners in the concentration camps were exposed. The reaction to these revelations was the Nuremberg Code in which the principles of ethical research on human subjects were formulated for the first time. The Code was later replaced by the Declaration of Helsinki, which is the most important document drawn up by The World Medical Association (WMA General Assembly, 2008). The principles of informed consent, beneficence and non-maleficence are the cornerstone of all provisions contained in both documents (Israel & Hay 2006:27-40).

Qualitative research, which often consists of observation, interviews or questionnaires, "…typically depends upon a degree of personal and social invasiveness" (Eckstein 2003:46). Most of the time the associated risk is minimal, but some research has the potential of being highly invasive socially and emotionally and then the expected benefits, as well as the effectiveness of the protective measures envisaged must be weighed carefully.

Ethical issues may arise throughout the research process and it is mandatory to address them properly during the planning stage. In fact, the first ethical decisions are being made at the time of the selection of the topic and methods (Punch, as reported by Hanafin 2004:47). Here the ethical dimension in the choice of subject is that the results should have an impact on the quality of training of future doctors and, by consequence, on the health on a large number of people who are going to be cared for by them. The choice of Delphi as a method presents the ethical advantage of not harming the subjects while producing superior results by comparison to other possible methods.

The obvious possible sources of harm to the participants were the breach of confidentiality and anonymity. The only person who had access to the names and other particulars of the participants, such as title, workplace and e-mail address, was the researcher. The answers to the questionnaires were coded for the name of the originator. All codes, as well as the original answers, are kept in a locked cabinet to which only the researcher has access. The feedback offered to the participants was in statistical form (percentages) and did not include any individual comments or names. This method ensured the anonymity of those who took part in the study.

Another issue, as highlighted by Asai (2003), is true voluntary participation; when subjects do not enrol voluntarily in a questionnaire survey, the authenticity of the answers cannot be guaranteed. In this study, only the voluntariness of the students' participation may be questioned, as they were still in the faculty at the time. However, they had graduated from the

haematology course two years previously, so their opinions could be considered to be fairly unhindered by their position. Moreover, the perennial experience of student feedback, even during the haematology course, shows that, given that the anonymity of the answers is ensured, opinions (including those that are not appreciative) are expressed freely, so the effect of potential coercion on the students to participate is fairly theoretical.

The requirement of informed consent was satisfied by first, in detail and in writing, explaining the purpose of the study; the Delphi process; what would be required from the participants; how their anonymity and the confidentiality of their answers would be ensured; and how the results would be used. All participants signed formal consent. They were free to withdraw from the study at any time, without any consequence to them.

The research protocol obtained approval from the Ethics Committee of the Faculty of Health. The e-mail address and telephone number of the researcher were made available to the participants for any enquiry.

3.9 Paradigmatic assumptions

The placement of this chapter here is intentional: the choice of research subject and the choice of method were purely guided by pragmatic considerations. The method appeared best suited to the purpose of the study and was tested before, although not in the domain of haematology curriculum development, with good results. It would be preposterous to maintain that the researcher first scrutinised her system of philosophical concepts (or the available philosophical systems) and then chose the most appropriate theme and method of study. However, she would agree with Mitroff and Turoff (2002:17) that "...not only are we generally unaware of the different philosophical images that underlie our various technical models, but each of us has a fundamental image of reality that runs so deep that often we are the last to know that we hold it". As a result, "...we are indeed the prisoners of our basic images of reality".

The aim of this subchapter, however, is not to explore the author's basic image of reality but to analyse the philosophical base of the Delphi method. Defining the philosophical underpinnings of a method is justified by the notion that it may be logically and convincingly constructed but still remains invalid if its underlying basic system of concepts about the nature of the reality and the way in which we know this reality are wrong.

It is necessary to start from analysing what the method consists of: it elicits opinions of the participants on the curriculum content and then communicates to them the opinions of the other participants grouped according to similarity. As a result, the participants would modify their opinions on the curriculum most of the time. The repetition of the word "opinion" is intentional here, as it indicates that the method deals with a mental construct of a fragment of the reality (i.e. the curriculum) that exists outside of the subject but is only known through the subject's perspective and values. Operating in this way, Delphi belongs to an interpretivist epistemology.

Ritchie and Lewis (2003:17) summarise the features of an interpretivist epistemology as follows: "The researcher and the social world impact on each other; facts and values are not distinct and findings are inevitably influenced by the researcher's perspective and values…; the methods of the natural sciences are not appropriate, because the social world is not governed by law-like regularities but is mediated through meaning and human agency…".

Most appropriate for illustrating the insertion of Delphi in the interpretivist system of thinking is the depiction of the way knowledge is acquired within such a system by Guba and Lincoln (1994:113): "Knowledge consists of those constructions about which there is a relative consensus (or at least some movement towards consensus) among those competent (and in the case of more arcane materials, trusted) to interpret the substance of the construction. Multiple 'knowledges' can coexist when equally competent (or trusted) interpreters disagree". For Delphi too, the knowledge is constructed through consensus of "experts" and disagreement is acknowledged as a valuable way of knowing the reality.

Hanafin (2004:7) identifies the principles of social constructivism in the process of fostering consensus by interacting with the opinions of the other research subjects. Social constructivists focus on the influence of "environmental inputs" in building a person's representation of reality and the structured feedback is precisely such an input.

The only objection to this credible integration of the Delphi method in an interpretivist epistemology is the fact that it may use statistical methods to quantify the consensus among the participants' opinions. Almost automatically, quantification directs the thinking towards the positivist epistemology, where the world exists independent and unaffected by the researcher and therefore she/he can use measurements to reliably describe the reality. However, while there can be no doubt in the reliability of the quantification of the consensus by statistical methods, this is not central to the method and does not detract from its

interpretivist characteristics. The notion of consensus itself is variously interpreted and many do not resort to calculations in order to define it. For this reason, although Delphi is a mixed method, as shown in 5.6, it is anchored in the interpretivist paradigm.

3.10 The coding and analysis of open-ended questions

This technique was applied to the open-ended questionnaires in order to extract the meaning from the raw answers and structure it. According to Auerbach and Silverstein (2003:43), this technique may be described in six steps. It begins with explicitly stating the researcher's concerns and her/his theoretical framework, so that they can be kept in mind easily during the procedure. With these in mind, relevant text is selected, for instance by highlighting it. In these fragments of text, repeating ideas are now identified. Further, by grouping these ideas into coherent categories, themes can be developed. In the next step, themes are condensed together into more abstract concepts, named theoretical constructs, which should be consistent with the theoretical framework of the research. Finally, a theoretical narrative is created by retelling the participants' stories in terms of the theoretical construction, and illustrating it with quotes from the participants' actual answers. While this mental process often happens spontaneously, intuitively, when studying a text, its conscious application helps when large amounts of raw data need to be analysed. Moreover, the systematic use of a defined method adds to the validity of the results of the research.

3.11 Conclusion

The choice of the Delphi method, combined with an open-ended questionnaire, appeared suitable due to the possibility it offered to elicit opinions from a larger number of participants, without having to bring them together or having to interview them in person. The main disadvantage of this approach resides in the impossibility for the researcher to pursue ideas that are expressed in a vague manner by the participants: there is no way of exploring issues in more depth than they appear to have from the received answers. This disadvantage may be compensated for to some extent by the larger number of respondents, while in one-on-one interviews constraints of time and resources might drastically limit the number of those interviewed.

The next chapter presents the findings from surveying the 64 panellists on the usefulness for practice of the undergraduate haematology programme at the Faculty of Health Sciences, University of Stellenbosch.

Chapter 4

RESULTS

Out of intense complexities intense simplicities emerge. Winston Churchill

4.1 Demographic data of the panel members

The Delphi questionnaire was sent to 64 participants. In order to obtain consistent triangulation of the data, the following groups were invited to participate: twenty general practitioners and ten interns, graduates of the Faculty of Health at Stellenbosch University; five adult haematologists, ten paediatric haematologists, four laboratory haematologists, and twenty sixth-year students. All participants were working in the Western Cape, with the exception of some paediatric haematologists who were located in other areas. Twelve general practitioners were employed as medical officers in district hospitals and the remaining eight were in private practice.

Out of the ten paediatric haematologists, nine were working full-time in government hospitals and one only part-time. By gender, these were five female and five male haematologists. The adult medicine haematologists were all male and were all employed in tertiary hospitals in the Western Cape. The laboratory haematologists' gender distribution was two male and two female. The interns were in their first or second year, equally comprising five males and five females. The students were predominantly female (eight out of fourteen) and were on a rotation in paediatrics at the time.

All categories mentioned above had a response rate of 100% throughout, except for the students; out of the initial 20 students, only 14 answered: a response rate of 70%.

The duration of the Delphi process was shorter than the eight months planned: from May to August 2008.

4.2 Analysis of the open questionnaire answers

Open questionnaires were used to obtain suggestions for a list of items which later would be ranked according to the chosen criteria, by a Delphi iterative consultation of the panellists. However, beyond the simple item designation, the answers contained a variety of data which could inform the developers of the curriculum. By using a qualitative analysis approach based on coding and categorising and reflecting on the structured data, information beyond the simple listing was brought to light.

4.2.1 Analysis of the answers to the first two questions

The first and the second open question elicited very similar information and therefore the answers could be analysed together. Question 1 was formulated as follows: "Have you required any haematological knowledge and skills in the last year? If so, please describe them". The next question was: "What haematological problems have impacted on the health of your patients in the last year?" The answers were analysed within each professional group and comparisons between groups were made along the way.

4.2.1.1 Answers received from general practitioners

By using the coding line by line technique, a number of 109 codes were identified, many of them recurrent; they were then grouped in 16 categories, representing the diseases or groups of diseases or skills. These data are presented in Table 4.1, page 78. An additional number of two codes had no relation with haematology: "poor access to blood products after hours" appeared once and "poor daily diet of white bread and Coke" appeared once.

The answers were further analysed for meaning. A first observation is that the words "approach" and "diagnosis" appear frequently in the answers*: "diagnosis of lymphadenopathies", "general approach to low platelets", "diagnose cause of anaemia"* and *"approach in bleeding anomalies"*. Indeed, much more often than the practitioners working in secondary and tertiary care, the generalists need to use the art of differential diagnosis during the first contact with their patients, and the correct identification of the

disease, or at least of the family of diseases, is often essential for a correct referral leading to proper treatment and recovery. A good curriculum must therefore maintain a well-considered balance between the descriptive presentation of disease and the integrative approach encompassing algorithms to facilitate the differential diagnosis.

Table 4.1: Haematological diseases frequently seen in general practice by panel members

DISEASE OR GROUP OF DISEASES	MEN-TIONS	%	SPECIFICATIONS	MEN-TIONS	%
Anaemia	42	39.6	Iron deficiency	10	9.4
			Approach to anaemia	9	8.4
			Thalassemia	3	2.8
			Due to blood loss	2	1.8
			Due to chronic disease	2	1.8
			In elderly	2	1.8
			Macrocytic	2	1.8
			Pernicious	2	1.8
			In pregnancy	2	1.8
			Haemolytic	1	0.9
			In children	1	0.9
			In Jehovah's witnesses	1	0.9
			Malaria	1	0.9
			Neonatal, due to sepsis	1	0.9
			Neonatal, isoimmunisation	1	0.9
			Sickle cell anaemia	1	0.9
			Spherocytosis	1	0.9
Haematological changes in HIV infection	14	13.2	None		
Lymphoprolifera-tive disorders	13	12.2	Approach to leukaemias	5	4.7
			Chronic lymphoid leukaemia	2	1.8
			Myeloma	2	1.8

			Approach to leukocytosis	1	0.9
			Approach to lymphadenopathy	1	0.9
			Lymphoma	1	0.9
			Approach to all lymphoproliferative disorders	1	0.9
Investigations	8	7.5	Interpretation of FBC	4	3.7
			Interpretation of clotting tests	2	1.8
			Indications	1	0.9
			Use in resource-poor setting	1	0.9
Thrombocytope-nia	6	5.6	Immune thrombocytopenia	3	2.8
			Approach to thrombocytopenia	3	2.8
Approach to pancytopenia	4	3.7	None		
Approach to bleeding	3	2.8	None		
Blood transfusion	3	2.8	Iron overload	2	1.8
			Haemolysis	1	0.9
Anticoagulants	2	1.8	Use	1	0.9
			Drug interactions	1	0.9
Chemotherapy	2	1.8	Follow-up	1	0.9
			Side-effects	1	0.9
Haemophilia management	2	1.8	None		
Neutropenia, approach	2	1.8	None		
Polycythaemia, approach	2	1.8	None		
Bruising, approach	1	0.9	None		
Hypercoagulation approach	1	0.9	None		
Thrombocytosis, approach	1	0.9	None		
TOTAL	106				

Anaemia is by far the most frequently encountered haematological problem in general practice, representing 39,6% of all items mentioned in the questionnaires. Practically all types

of anaemia appeared in the answers, with a clear predominance of the one resulting from iron deficiency (9.4%). Reflecting to some extent the strong migration of refugees from Central Africa, thalassemia and sickle cell anaemia are mentioned more frequently than expected: *"thalassemia (person/patient from the DRC)"*

The haematological changes secondary to human immunodeficiency virus (HIV) infection – or the treatment with antiretrovirals – appeared as of concern for the practitioners in 13,2% of all items listed in the answers. They need to be taken into account when attempting differential diagnosis in anaemia. While they are currently included in the haematology course, many generalists who graduated decades ago have had to upgrade their knowledge from other sources and some uncertainties may still persist on this issue.

The approach to lymphoproliferative disorders occupies a high ranking among the problems encountered in the practice of the respondents (12.2%) and this is perhaps counterintuitive, as these malignancies generally are perceived as being rare.

The rational use of investigations in limited-resource settings is mentioned only once in the answers but it, in fact, is a frequent issue in the activity of practitioners at all levels. It deserves constant attention in any medical curriculum at a time when costs of health care are escalating worldwide.

A few issues mentioned in the answers have no connection with haematology or the curriculum. Nevertheless, they deserve brief notice here, because of the strong impression they give of the general environment where the respondents work. An item such as "*poor access to blood products after hours*" reflects, perhaps, an obsessive preoccupation, originating in a feeling of powerlessness, with major shortcomings of the health care system, while "*poor daily diet of white bread and Coke*" illustrates the perception of an enormous lack of awareness of healthy eating principles which persists in some groups of the population and is a constant source of disease.

4.2.1.2 Answers from interns

Thirty-five codes were identified in these answers, which could be grouped in 12 categories (see Table 4.2).

Table 4.2: Haematological diseases or skills frequently encountered by interns

DISEASE OR SKILL	MEN-TIONS	%	SPECIFICATIONS	MEN-TIONS	%
Anaemia	13	37.1	Unspecified	4	11.4
			Various types	2	5.7
			Chronic disease	2	5.7
			Treatment	2	5.7
			Iron deficiency	1	2.8
			Nutritional	1	2.8
			Haemolytic	1	2.8
Test results interpretation	5	14.2	None		
Leukaemia	5	14.2	Unspecified	2	5.7
			Acute	1	2.8
			Acute lymphoid	1	2.8
			Acute myeloid	1	2.8
Blood transfusion	3	8.5	None		
HIV, haematological changes	2	5.7	None		
Approach to bleeding disorders	1	2.8	None		
Bone marrow biopsy	1	2.8	None		
Clotting abnormalities, approach	1	2.8	None		
Haematological malignancies	1	2.8	None		
Leucocytosis, interpretation	1	2.8	None		

Polycythaemia	1	2.8	None		
Thrombocyto-paenia	1	2.8	None		
TOTAL	**35**				

On further analysis, the significant frequency of mentioning of "*interpretation of results*" was noted. This is a reflection of the specifics of intern training, which consists of rotation through core disciplines such as surgery, paediatrics, obstetrics – gynaecology – and internal medicine. As a result, contact with haematological conditions is limited, but they will always be required to interpret blood count results. Even so, in their practice, they encounter blood diseases, and anaemia of various types appears again to be the most frequent condition seen (37.1% of all items mentioned). A variety of etiologies of anaemia was mentioned. The second highest frequency of mentioning is for leukemia (14.2%), again illustrating the incidence and seriousness of this pathology among the patients usually seen by interns. Another frequent intern duty is to organise and monitor blood transfusions and this explains the importance attached by them to the knowledge pertaining to transfusion (8.5%).

Haematological changes in the course of HIV infection are probably less often seen by interns, as they were only mentioned twice. Another six items (leucocytosis, thrombocytopenia, polycythaemia, clotting abnormalities, bleeding disorders and bone marrow biopsy) each appeared only once in the results, but their presence gives further evidence of the fact that haematological disease continues to be encountered, even when one's practice is restricted to one or another speciality of medicine.

4.2.1.3 Answers from final year students

The questionnaire for students was adapted to account for the fact that, unlike the other participants to the panel, they did not really practise, not even in a hospital. Thus, the first question explored the haematological knowledge and skills that they had to use during the practical stages, but the following two questions rather targeted the contents of the curriculum and its usefulness from the perspective gained by a further two years of clerkship after finishing the haematology module. Only the answers to the first question will be analysed

here. A number of 50 codes were identified and grouped in 16 categories, as shown in Table 4.3.

Table 4.3: Haematological diseases encountered by students after finishing the haematology module

DISEASE OR SKILL	MEN-TIONS	%	SPECIFICATIONS	MEN-TIONS	%
Anaemia	18	36	None	4	8
			Approach	3	6
			Various types	2	4
			Treatment	1	2
			Thalassemia	1	2
			Sickle cell	1	2
			Spherocytosis	1	2
			Microcytic	1	2
			Macrocytic	1	2
			Iron deficiency	1	2
			Haemolytic	1	2
			In pregnancy	1	2
Blood transfusion	5	10	None		
Leukemia	5	10	None		
Bleeding	4	8	Approach	1	2

disorders			None	3	6
Lymphoma	3	6	None		
Thrombocyto-paenia	2	4	None		
Immune thrombocyto-penia	2	4	None		
Haematological changes in HIV	2	4	None		
Anticoagulant therapy	2	4	None		
Autoimmune haematological disease	1	2	None		
Disseminated intravascular coagulation	1	2	None		
Haematological malignancies	1	2	None		
Interpretation of slides	1	2	None		
Myeloma	1	2	None		
Splenomegaly	1	2	None		
Thrombocytosis	1	2	None		
TOTAL	**50**				

Anaemia again emerged at the top of the list, with 36% of all nominations, as a condition frequently seen during student practice. All types of anaemia were encountered, with several mentions of differential diagnosis and approach, which reinforce the opinion expressed earlier in this analysis, that integrative lectures would be extremely useful for the practice.

Malignant haematological disease was mentioned less frequently than anaemia, but was nevertheless high on the list: “haematological malignancies”, “leukemia”, “lymphoma” and

"myeloma" constituted together 20% of the items noted. This probably is the consequence of a notable prevalence of such diseases among the hospitalised patients who are usually seen by the students. Blood transfusion was also a frequently nominated item (10%): indeed, this is a daily event in surgical, orthopaedic and obstetrical wards and a frequent reason for admission to hospital.

"Bleeding disorders", "splenomegaly", "thrombocytopenia" and "thrombocytosis" were mentioned without any attributes. However, these are only symptoms or syndromes and their nomination is best interpreted as an expression of the need to be able to handle their differential diagnosis (again, the "approach" to interpreting these was required by the students' practice.)

There was a substantial similitude between the students' answers and the general practitioners' answers, although the students were not practising yet. This may be interpreted as a result of training the students in an adequate environment which exposes them to more or less the same health care issues that are being encountered in the generalist practice.

4.2.1.4 Answers from the haematologists

Three groups of haematologists participated in the study: adult medicine, paediatric and laboratory haematologists. Their questionnaires were different from the other participants' in that they directly elicited their opinions on which subjects of study should be included, excluded or have only marginal value for the syllabus. Their answers will not be analysed here but further down, after the presentation of the responses from general practitioners, interns and students to the questions targeting directly the curriculum content.

4.2.2 Analysis of the answers to questions directly exploring opinions about the curriculum content

These were questions investigating opinions on the haematology curriculum and asking for suggestions about topics that should be included, excluded or only be given marginal attention in the syllabus.

4.2.2.1 Answers received from general practitioners

The last two questions were formulated as follows: "What comments do you have about your own undergraduate haematology training? Was there anything which was not taught but which would have been helpful in your present activity?" and "Which elements of the theory and skills are 'marginal' for inclusion/exclusion in an undergraduate training programme?"

Only 15 comments on the overall quality of the haematology course were returned. Seven participants found their haematology training adequate: "*Was really good and comprehensive. Always refer back to class notes.*" Three of these, however, graduated long ago and might not have had a strong recollection of their studies. Five evaluated their training as poor: "*need(ed) more practical advice"*; "*I usually need to consult the book or the Internet*" (because the course was not comprehensive enough); "*too much scientific information, too little everyday practice*". For another three respondents, the course was confusing: "*flooded with information which was not selected*"; "*lack of system*" and "*confusing due to lack of clinical background*". These 15 respondents, by virtue of their various ages, did not refer to the same syllabus. It is also possible that bad memories fade faster. What matters is the suggestion that the course lacked system and did not keep a reasonable balance between basic pathophysiology data and useful clinical information.

Connected to this criticism, again, is the expression of the need to learn about the right approach to diagnosing haematological diseases: "*approach to common conditions*"; "*approach to anaemia, leukemia*". References to "approach" were made seven times. A number of 10 proposals referred to items that should be included in the course, along with the existing ones (see Table 4.2). These were mainly about practical skills: "*fine needle aspiration*"; "*bedside tests*" and about the haematological consequences of HIV infection. Seven items were proposed for exclusion from the syllabus: rare conditions (three times), and "*nitty-gritty, molecular mechanisms*" or simply "*mechanisms*" were leading the list.

Without direct connection with the area of this research, but significant for the general design of the training of doctors, was the frequent mentioning of the need to update professional knowledge (eight times).

Table 4.4: Opinions on the course and items for inclusion or exclusion as formulated by general practitioners

CATEGORY	MEN-TIONS	%	ITEMS	MEN-TIONS	%
Course was good	7	14.8	Really good and comprehensive; always refer to class notes	1	2.1
			We were thoroughly trained	1	2.1
			Good training but needs regular updating	1	2.1
			I think the training was good	1	2.1
			None	3	6.3
Course was deficient	5	10.6	More practical advice	1	2.1
			Not comprehensive enough	1	2.1
			Not practice oriented	1	2.1
			Too much scientific info	1	2.1
			Too short	1	2.1
Course was confusing	3	6.3	Flooded with unselected information	1	2.1
			Lacked system	1	2.1
			Due to lack of clinical background	1	2.1
Suggestions for inclusion	17	36.1	Approach to various areas of haematology	7	14.8
			HIV-related changes	3	6.3
			Fine needle aspiration training	2	4.2
			Simple bedside tests	1	2.1
			The biggest question is when to refer	1	2.1
			Macrocytic anaemia	1	2.1
			Haematological malignancies	1	2.1
			Interpretation of FBC and smear	1	2.1
For exclusion	7	14.8	Details on rare conditions	2	4.2

			Less common problems, Fanconi anaemia	2	4.2
			Mechanisms	2	4.2
			Some anaemias	1	2.1
Mentioned need for updating	8	17	None		
TOTAL	47				

4.2.2.2 Answers received from interns

One of the ten interns did not respond to this part of the questionnaire. Four respondents found the haematology course to be adequate: "*Undergraduate training was good – laid a foundation for the future*". An equal number of respondents thought that the course was too short: "*We had one week training but too much details (sic) to remember in such short time*". The paucity of practical information was a problem for three participants: "*It was good training but very practical things were not always explained*". "*Too much emphasis on rare malignancies and not much focus on practical use and common disorders*". The insufficient information on the influence of HIV and its combination with tuberculosis on the blood and blood-forming organs was mentioned once only. Another respondent mentioned the, by now very familiar, theme of the approach to haematological diseases.

4.2.2.3 Answers formulated by final year students

The students could not offer a perspective on the course based on their experience in real generalist practice yet. They were therefore asked to imagine how the haematology knowledge was going to assist their future work; they were also asked to what extent the course contributed to their understanding of matters learnt in other disciplines. These questions were formulated as follows: "What subjects and skills taught in haematology would be useful for your future practice and which ones do you consider less useful?" and "List elements of haematology which are helping you in understanding normal and pathological

processes in humans. List separately those elements that you think should be taught but are not yet in the curriculum". The answers are summarised in Table 4.5.

Table 4.5: Items for inclusion or exclusion proposed by the students

CATEGORY	MEN-TIONS	%	ITEMS	MEN-TIONS	%
Emphasis	36	72	Anaemia	6	12
			Bleeding tendencies	5	10
			Leukemia	4	8
			Blood transfusion	3	6
			Interpreting and doing slide tests	3	6
			Lymphoma	3	6
			Anticoagulant therapy	2	4
			Blood groups, Rh	2	4
			HIV-associated changes	2	4
			Common conditions	1	2
			Interpret clotting tests	1	2
			Lab results	1	2
			Practical skills e.g. bone marrow biopsy	1	2
			Secondary polycythaemia	1	2
			Small-group sessions in simulated cases	1	2
Less of	6	12	Detail on investigations: only which, why, basics on how done	1	2
			Laboratory: you won't work in a lab as GP	1	2

			Management which needs specialist	1	2
			Tests we will never do	1	2
			Uncommon hereditary disease not immediately mortal	1	2
			Anything beyond interpretation of FBC	1	2
Approach to	7	14	Abnormal FBC	1	2
			Investigations in various clinical pictures	1	2
			Anaemia	1	2
			Various investigation results	1	2
			Various symptoms/signs	1	2
			Non-specified	1	2
			Abnormal blood results	1	2
All topics relevant	1	2	However, important things get lost in the whole	1	2
TOTAL	**50**			50	

The general impression derived from the answers is that the students already have a comprehensive idea of the nature of the work of a general practitioner (see also paragraph 2.1.3 above). They made precise proposals on which matters should be preponderant in the syllabus and which ones should be summarily presented only. Anaemia, bleeding tendencies, blood transfusion, leukemia and lymphoma were nominated at a higher rate than other conditions. The students' opinions on what should get less coverage in the course were well formed: "*less detail on investigations: only which, why and basics on how done*"; "*less laboratory: you won't work in a lab as GP*"; "*less information on uncommon hereditary disease not immediately mortal, which we would in any case refer to a tertiary centre*". Much the same as other groups of participants in the study, the students need guidelines on differential diagnosis and essentials of management: the "approach" issue, as it has already

emerged from previous answers, was strongly represented in students' submissions, too (14% of items mentioned).

4.2.2.4 The opinions of the haematologists on the contents of the course

It was expected from the "owners" of the discipline that they would provide most of the suggestions for the syllabus. Indeed, one hundred items were counted, which were grouped in three categories: suggestions for inclusion in the syllabus, suggestions for exclusion and potential subjects for inclusion. All these are listed in Table 4.6.

Table 4.6: Suggestions by haematologists for inclusion or exclusion from the syllabus

CATEGORY	MEN-TIONS	%	ITEMS	MEN-TIONS	%
Include in syllabus	76	76	Acquired clotting disorders	1	1
			Anaemia	5	5
			Approach anaemia	3	3
			Approach to bleeding disorders	3	3
			Approach to cytoses and cytopenias	2	2
			Approach to lymphadenopathy	1	1
			Approach to splenomegaly	1	1
			Approach to thrombosis	2	2
			Awareness	1	1
			Basic core knowledge in lecture notes	1	1
			Basic knowledge	1	1
			Bleeding tendency	2	2
			Blood transfusion	1	1
			Bone marrow transplant	1	1
			Cell biology	1	1
			Common haematological conditions	1	1

			Haemoglobin diseases	1	1
			Haemoglobin function/structure	2	2
			Haemostasis physiology	1	1
			Haemophilia	3	3
			HIV haematol. changes, management	2	2
			Hypersplenism	1	1
			Interpret full blood count	5	5
			Interpret haematological tests and how they work	2	2
			Iron physiology, folate, B12	1	1
			Immune thrombocytopenic purpura	2	2
			Leukemia	4	4
			Lymphoma	4	4
			Morphology bone marrow aspirate	1	1
			Morphology bone marrow trephine	1	1
			Morphology of peripheral smear	1	1
			Myelodysplasia	2	2
			Myeloma	3	3
			Neonatal haematology	1	1
			Platelets function	1	1
			Emphasis on practical, relevant items	1	1
			Red cell function, normal parameters	1	1
			Red flag signs of cancer	1	1
			Sideroom tests, e.g. Hb	1	1
			Splenectomy	1	1
			Stem cells vs peripheral blood	1	1
			Thrombophilia	1	1
			Thrombotic thrombocytopenic purpura	1	1
			White cell function, parameters	1	1

			White cell response in infection	1	1
			Working knowledge on haematological malignancies	1	1
Exclude from syllabus	19	19	Bone marrow aspirate, biopsy	1	1
			Cancer genetics	4	4
			Classification of malignancy	1	1
			Cytostatics, protocols	5	5
			Details on bone marrow transplant requirements	2	2
			Lab skills, techniques	1	1
			Mechanisms of action of drugs	1	1
			Oncogenesis	1	1
			Performing fine needle aspiration	1	1
			Rare diseases	2	2
Maybe for inclusion	5	5	Bone marrow investigation	1	1
			Items covered in other disciplines: anaemia of neonate, Rh	1	1
			Glucose-6-phosphate dehydrogenase deficit, other rare genetic deficits	1	1
			Interpret computed tomographies, magnetic resonance imaging, positron emission tomographies	1	1
			Venepuncture when platelets low	1	1
TOTAL	**100**				

It is interesting to note, when perusing the haematologists' answers, that a large number of items are in fact concordant with the suggestions made by the other categories of "stakeholders" in the curriculum. Some of these are listed below:

- Exclude oncogenesis, cancer genetics.
- Exclude mechanisms of action of cytostatics and protocols.

- Exclude laboratory skills or techniques.
- Exclude rare diseases.
- Present more “approaches”.
- Present interpretation of tests.
- Blood transfusion.
- Include haematological changes due to HIV infection.
- Teach side room tests.
- Emphasis on that which is relevant for the practice.

Considering these similarities of opinion and others that may appear obvious to the reader, the question occurs, naturally, why so much apparent criticism was levelled at the haematology curriculum. Judging from the proposals of the haematologists, the curriculum might be close to ideal; however, we must reckon with the fact that these haematologists may not have had a voice in its drawing up. Looking from another angle, maybe the intended curriculum indeed, on paper, was adequate, but its execution might have betrayed the planning so often that the result was different from the one intended.

A number of suggestions were only advanced by the haematologists. Subjects such as those listed below did not appear among the answers of the other participants in the study:

- Haemoglobin structure and function
- Metabolism of iron, folic acid, vitamin B 12
- Cell biology; stem cells
- Functioning of red blood cells, platelets, white blood cells
- The morphology of bone marrow aspirate, bone marrow trephine biopsy and peripheral smear
- Bone marrow transplant

It appears that the haematologists consider situating the description of the pathology in the context of the biological phenomena which take place in the body as important, in order to

provide a deeper understanding. The doctors, situated at the receiving end of the curriculum, however, were more interested in using the knowledge gained in order to expeditiously establish a diagnosis and a plan of management or referral.

A final remark suggested from the assessment of the haematologists' answers is that the time allocated to the course may, indeed, be too short to allow for the volume of information that needs to be handed on. This seems to be reinforced by some references in the answers of the trainees to the shortness of their training period.

4.3 Analysis of the results of the Delphi rounds

A list of subjects proposed to be taught in the haematology course was drawn up, after corroborating the suggestions, made by the participants, with the existing syllabus (see Addenda F p.163). The panellists were then invited to rate the items on the list on a scale from 1 to 4, according to the relevance for their practice, or, in the case of haematologists, according to the importance the subject should have within the curriculum. A score of 1 would mean that the panellist feels strongly that the subject should be excluded from the syllabus, a score of 2 signified a possible exclusion, a score of 3 indicated inclusion, but the subject was of moderate importance, while a subject scored with 4 meant essential.

Three rounds of Delphi questionnaires were run, whose results are presented graphically in diagram 4.1.

Diagram 4.1: Results of the Delphi process

Subject	Pediatric haematologists	Adult haematologists	Laboratory haematologists	Interns	Students	GP
Microcytic anaemia	**4**	**4**	**4**	**4**	**4**	**4**
Anaemia in pregnancy	**1**	**2**	**3**	**3**	**4**	**3**
Macrocytic anaemia	**3.6 (0.48)**	**4**	**4**	**4**	**4**	**3**
Normocytic anaemia	**3.2 (0.78)**	**3**	**4**	**4**	**4**	**3**
Neonatal anaemia	**4**	**2**	**3.5 (0.57)**	**4**	**4**	**1**
Anaemia in childhood	**4**	**2**	**3.5 (0.57)**	**4**	**4**	**3**

Iron deficiency anaemia	**4**	**4**	**4**	**4**	**4**	**4**
Haemolytic anaemia	**3.6 (0.69)**	**4**	**4**	**3.5 (0.50)**	**4**	**3.1 (0.74)**
Spherocytosis	**3.1 (0.99)**	**2**	**2**	**2.4 (0.51)**	**3**	**1**
Sickle cell anaemia	**3 (0.94)**	**3**	**3.5 (0.57)**	**2.2 (0.63)**	**3**	**1.5 (0.51)**
Thalassemia	**3 (0.94)**	**3 (0.70)**	**3.25 (0.95)**	**1.7 (0.9)**	**3**	**1.35 (0.48)**
Autoimmune haemolytic anaemia	**3.3 (0.67)**	**4**	**4**	**2.5 (0.7)**	**3**	**2**
Folate and vitamin B12 deficiency	**3.1 (0.99)**	**3**	**4**	**3.2 (0.63)**	**3**	**3**
Hereditary platelet defect	**2.6 ()1.01**	**1**	**3**	**2**	**3**	**2**
Acquired platelet defect	**3**	**4**	**4**	**2**	**3**	**1**
Bleeding child	**4**	**1**	**4**	**4**	**4**	**3**
Clotting tests interpretation	**4**	**4**	**4**	**4**	**4**	**2**
Splenomegaly	**4**	**4**	**4**	**4**	**4**	**4**
Lymphadenopathy	**4**	**4**	**4**	**4**	**4**	**4**
Thrombocytopenia	**4**	**4**	**4**	**4**	**4**	**4**
Thrombocytosis	**2 (0.81)**	**2.8 (0.83)**	**3**	**3**	**4**	**1.85 (0.74)**
Pancytopenia	**4**	**4**	**4**	**4**	**4**	**4**
Haematological changes of HIV/AIDS	**3 (0.81)**	**4**	**4**	**4**	**4**	**4**
Aplastic anaemia	**3.3 (0.67)**	**4**	**4**	**3**	**3**	**2**
Fanconi anaemia	**3.3 (0.67)**	**3**	**3**	**1.9 (0.7)**	**3**	**1.7 (0.65)**
Haemophilia	**4**	**2**	**4**	**2**	**4**	**1.75 (0.63)**

Secondary polycythaemia	**1.4 (0.51)**	**2.4 (0.54)**	**2**	**2**	**3**	**1.8 (0.69)**
Myelofibrosis	**1.4 (0.69)**	**3**	**2**	**2**	**2**	**2.35 (0.81)**
Neutropenia	**3.8 (1.1)**	**4**	**3**	**2.4 (0.69)**	**3.4 (0.53)**	**3.35 (0.74)**
Lymphopenia	**3.4 (0.96)**	**4**	**2.5 (0.57)**	**3**	**3.14 (0.53)**	**3.25 (0.78)**
Leukemia	**4**	**4**	**4**	**3**	**4**	**4**
Lymphoma	**4**	**4**	**3**	**3**	**4**	**4**
Myeloma	**1**	**4**	**3**	**2**	**4**	**2**
Monoclonal gammopathy	**1**	**3**	**3**	**2**	**2 (0.73)**	**1.8 (0.61)**
Cytostatics	**2.8 (1.2)**	**2.4 (0.54)**	**3 (1.15)**	**2**	**2**	**1**
Blood components	**4**	**4**	**4**	**4**	**4**	**4**
Blood groups	**4**	**4**	**3**	**4**	**4**	**2**
Rh	**4**	**3**	**4**	**4**	**4**	**2**
Blood transfusion	**4**	**4**	**3**	**4**	**4**	**3**
Thrombosis	**3 (0.66)**	**4**	**3**	**4**	**4**	**4**
Anticoagulant therapy	**2.7 (0.94)**	**4**	**3**	**4**	**4**	**4**
Hypercoagulopathy	**2.3 (0.84)**	**3**	**3**	**3**	**4**	**3**
Oncogenesis	**2.5 (1.5)**	**2.2 (0.83)**	**2.5 (0.57)**	**1**	**2.3 (1.0)**	**1**

1.....4 rating of the importance of the subject

Consensus attained in the first Delphi round

Consensus attained in the second Delphi round

Consensus attained in the third Delphi round

2.5 (1.5) No consensus; mean of ratings and standard deviation given (in brackets)

The Delphi process was run separately for each professional category. Consensus was defined as 80% or more of the participants in the professional group attributing the same rating to an item from the list, after any of the three rounds. Disagreement after the third round was analysed, however, to find an average value and a standard deviation, as these could give an indication of the prevailing trend in the thinking of the panel. Frequently, although consensus was reached within the professional groups, the chosen importance level for the subject was different from one group to another. This discrepancy was named 'discordance between groups' for the purpose of this study, while the choice of the same subject importance by two or several groups was 'concordance'.

4.3.1 Building up consensus

It is easy to identify the progress of the consensus in each group and overall, by means of the colour codes in Diagram 4.1. Table 4.7 expresses, in percentages, the increase of agreement within each group with iteration of Delphi, thus bearing evidence to the efficacy of the method in consolidating the opinions of the panellists. A notable fact is that most of the consensus occurred in the first two rounds for almost all groups, with the exception of one (interns). This corresponds with observations of other Delphi users (Linstone & Turoff 2002).

Table 4.7: Progression of consensus after each Delphi iteration

PROFESSIONAL GROUP	ROUND ONE		ROUND TWO		ROUND THREE	
	TOTAL ITEMS AGREED UPON	%	TOTAL ITEMS AGREED UPON	%	TOTAL ITEMS AGREED UPON	%
General practitioners	8	18.6	25	58.1	31	72.0
Students	17	39.5	29	67.4	39	90.6
Interns	4	9.3	19	44.1	35	81.3
Haematologists paediatricians	10	23.2	19	44.1	21	48.8

Haematologists for adults	**16**	**37.2**	**30**	**69.7**	**38**	**88.3**
Laboratory haematologists	**18**	**41.8**	**32**	**74.4**	**36**	**83.7**

In the remaining part of this chapter, the evaluation of each subject by the panellists will be presented and discussed. The order of presentation will be that used in phase one questionnaires.

4.3.2 Microcytic anaemia

This type of anaemia is the most frequently encountered one and, as such, it has been given the rating of 4 – essential, by all groups, with consensus within each group and complete concordance between groups.

4.3.3 Anaemia in pregnancy

There was consensus on this subject within each group. However, there was maximum discordance between groups, anaemia in pregnancy having received ratings from 1 to 4. This discordance can be attributed to the distinct professional perspective of the panellists and will be seen repeatedly in the analysis of the results. Paediatricians have rated the subject with 1: in their view it should be excluded from the syllabus. They never see or treat anaemia in pregnancy, though. Adult medicine haematologists gave it a rating of 2 – possible exclusion or inclusion with minimum importance. Indeed, in the field of adult haematology this is a rare disease, as it, in fact, is seen mainly by the obstetricians. Laboratory haematologists rated it as of moderate importance – 3, presumably because it is frequently detected in the mandatory laboratory testing of pregnant women who are seen in antenatal clinics. Interns and students rated it as essential – 4, reflecting probably the frequent encountering of this condition during their obstetrics rotations, while general practitioners gave it a rating of 3. This last evaluation is perhaps the most realistic, as anaemia in pregnancy is frequently seen in women but is easily diagnosed and treated and will not persist beyond the end of the gestation.

4.3.4 Macrocytic anaemia

With the exception of paediatric haematologists, all other professional groups reached consensus on this subject. Adult medicine haematologists, laboratory haematologists, interns and students have rated macrocytic anaemia as essential within the syllabus. Paediatric haematologists could not attain consensus but their ratings averaged 3.6, with a standard deviation (SD) of 0.48 and this indicates that they think that this is a major subject. General practitioners, however, rated it as having moderate importance, probably due to its relative rarity in daily practice.

4.3.5 Normocytic anaemia

Consensus was attained in all groups, excepting that of the paediatric haematologists, whose evaluations averaged 3.2, with a relatively large dispersion: SD = 0.78. Most of the panel groups which reached consensus attribute to this subject an "essential" rating, i.e. 4, but for the general practitioners it has only moderate importance (rated 3), probably due to its infrequent occurrence among their patients.

4.3.6 Neonatal anaemia

Laboratory haematologists could not reach consensus here, with an average of ratings of 3.5 and a SD of 0.57. The opinions of the remaining participants were unified among members of their group, with significant discordance, though, between teams. Paediatric haematologists, interns and students rated the subject with a 4 – essential. The adult haematologists' rating was 2 and the generalists' 1. Again, this discordance needs to be seen in the light of the fact that haematologists involved with adult medicine and general practitioners do not see newborns in their practices.

4.3.7 Anaemia in childhood

This is an essential subject according to the paediatricians, interns and students who rated it accordingly, with 4. Adult medicine haematologists, however, would never deal with this health issue and rated it as having little importance. Generalists did not see it as essential,

although they ascribe to it a moderate importance. Laboratory specialists could not reach consensus, but their average rating was 3.5 with an SD of 0.57.

4.3.8 Iron deficiency anaemia

This is the most frequently encountered anaemia at any age and, as a result, it was rated with 4 by all participating groups.

4.3.9 Haemolytic anaemia

Paediatric haematologists, interns and general practitioners did not reach consensus on this subject, but their average ratings indicated that they consider it to be important: 3.6 (SD = 0.69), 3.5 (SD = 0.50) and 3.1 (SD = 0.74) respectively. The other groups saw it, in consensus, as being essential.

4.3.10 Spherocytosis

Generalists voted in consensus to exclude this subject from the syllabus, thus indicating its rarity. The other groups, however, were not so drastic: adult haematologists rated it as having little importance, while laboratory haematologists and students thought it to be moderately important; so did most of the paediatric haematologists: the average rating was 3.1 in this group, with a SD of 0.99. Interns, too, could not arrive at consensus but their average rating was only 2.4 (SD = 0.51).

4.3.11 Sickle cell anaemia

Most haematologists did not agree on the importance of this subject but the trend nevertheless was to rate it as moderately important: paediatric haematologists' ratings averaged 3 with SD = 0.94; adult haematologists, in consensus, rated it as essential (score: 4) and laboratory haematologists' averaged ratings were at 3.5 (SD = 0.57). Students agreed to rate it as moderately important. Interns and general practitioners could not arrive at consensus but their averaged ratings indicate only a moderate to low importance of this subject in practice: 2.2

(SD = 0.63) was the interns' rating and 1.5 (SD = 0.51) was assigned by general practitioners. In the daily reality of practice, sickle cell anaemia is rarely seen in South Africa (the sickle cell gene is present only in some 1% of the population and only the homozygotes have a severe anaemia). It is, however, a complex disease, relatively difficult to treat, requiring precise knowledge from the physician.

4.3.12 Thalassemia

With the exception of students, no group registered consensus on the relative importance of this genetic disease. A distinction can be clearly seen between haematologists and students, on the one side, who seem to share a more scholastic view of the disease, and the interns and general practitioners, on the other side, who attribute little importance to it, probably due to its rarity in South Africa. Thalassaemia, indeed is much more frequently seen in particular geographical areas, such as the Mediterranean basin. The noted ratings were: paediatricians 3 (SD = 0.94); adult haematologists 3 (SD = 0.70); laboratory haematologists 3.25 (SD = 0.95); interns 1.7 (SD = 0.90); students 3 (in consensus) and generalists 1.35 (SD = 0.48).

4.3.13 Autoimmune haemolytic anaemia

The same discordance in ratings between the groups more closely connected with the faculty, i.e. haematologists and students and graduates confronting the realities of medical practice "at the coalface", is seen here. Paediatric haematologists could not reach consensus, but they recorded an average rating of 3.3 (SD = 0.67); the other two groups of haematologists gave a rating of 4 and the students one of 3. For these categories of participants, who happened to be linked together by the fact that some of them teach haematology and the others have been taught recently, this disease is important, even essential for the syllabus. Not so for the general practitioners who, in consensus, attributed to it a rating of 2; the interns scored it a little higher, at 2.5 (SD = 0.7).

4.3.14 Folate or vitamin B12 deficiency

There is a degree of concordance in the opinions of various groups: adult haematologists and general practitioners rated this subject as moderately important, while laboratory haematologists and students see it as essential; there is consensus within these groups. The remaining participants did not arrive at consensus: paediatricians' ratings averaged 3.1 (SD = 0.99) and the ratings of interns, on average, were 3.2 (SD = 0.63).

4.3.15 Hereditary platelet defects

With the exception of the paediatric haematologists, whose ratings could not reach consensus but averaged at 2.6 (SD = 1.01), all other participants harmonised their opinions within each group. Among groups, the ratings differed substantially, though: for the adult haematologists the issue was insignificant and may be excluded from the syllabus; interns and general practitioners saw it as a minor subject (rated 2), the students rated it at 3, this was an essential item but for the laboratory haematologists.

4.3.16 Acquired platelet defects

All professional categories attained consensus on this subject. There seems to be convergence in the ratings given by the specialist haematologists and the students and a different common tendency among interns and general practitioners, who are not connected to the faculty any more: the former category gave ratings of 3 and 4 to this subject, while the latter rated it at 2 (interns) and 1 (general practitioners).

4.3.17 Approach to bleeding child

All groups achieved consensus here. With the exception of adult haematologists, who rated it as insignificant (1), paediatricians and general practitioners see it as being moderately important (rating 3) while laboratory haematologists, interns and students categorise it as essential.

4.3.18 Interpretation of clotting tests

A very significant subject for all doctors working in a hospital, where patients with severe clotting anomalies will normally be encountered: all haematologists, interns and students decided in consensus to rate it at 4 (essential). In general practice, though, the clotting studies are limited to monitoring the odd patient who is taking anticoagulant medication, and therefore generalists rated the subject at 2 (minimal importance).

4.3.19 Approach to splenomegaly

This subject received a unanimous and consenting rating of 4 (essential) from the panellists.

4.3.20 Approach to lymphadenopathy

A very important aspect of haematology, this subject was also rated with 4 (essential) by all groups.

4.3.21 Approach to thrombocytopenia

Another frequent and serious condition, rated 4 (essential) by all groups in consensus.

4.3.22 Approach to thrombocytosis

This is certainly not a frequent condition and was mostly rated between 2 and 3; however not all groups managed to arrive at consensus. Paediatric haematologists, adult haematologists and general practitioners did not agree on the ratings; their averages were 2 (SD = 0.81), 2.8 (SD = 0.83) and 1.85 (SD = 0.74) respectively. Laboratory haematologists and interns rated the subject as moderately important (rating 3), while the students saw it as essential (rating 4).

4.3.23 Approach to pancytopenia

All groups reached consensus and rating this important subject as essential (rating 4).

4.3.24 Haematological changes in HIV infection / AIDS

Almost all groups rated this subject with 4 (essential) in consensus. Paediatricians, however, could not reach consensus and their ratings averaged 3 (SD = 0.81).

4.3.25 Aplastic anaemia

The paediatricians could not reach consensus on this item and their ratings averaged 3.3 (SD = 0.67). The other groups attained consensus but their ratings differed substantially. Adult medicine haematologists and laboratory haematologists considered it essential, while it had moderate importance for interns and students and only minimal interest for general practitioners (rating 2).

4.3.26 Fanconi anaemia

This disease presented little interest for the general practitioners: they could not attain consensus, but on average rated it at 1.7 (SD = 0.65). Interns could not reach consensus either and their ratings averaged 1.9 (SD = 0.7). The following groups rated it higher, in consensus: adult haematologists and laboratory haematologists rated it at 4 (essential), while students rated it at 3 (moderately important). Paediatric haematologists could not reach consensus and their average rating was 3.3 (0.67).

4.3.27 Haemophilia

General practitioners could not agree on a common rating and their assessments averaged 1.75 (SD = 0.63). For paediatricians, laboratory haematologists and students this subject was essential (rating 4). Adult haematologists rated it at 2 and interns at 3.

4.3.28 Secondary polycythaemia

A minor subject in the assessment of most participants, secondary polycythaemia was rated as presenting little interest (2) by laboratory haematologists and interns. Students gave it a slightly higher score of 3. The other groups did not achieve consensus but their averages are not far from a rating of 2: 1.4 (SD = 0.51) was the average assessment made by paediatricians, 2.4 (SD = 0.54) by adult medicine haematologists and 1.8 (SD = 0.69) by general practitioners.

4.3.29 Myelofibrosis

Adult haematologists rated this subject as moderately important (3); for the other groups that attained consensus, the subject had minimal importance (rating 2). The opinion of the remaining groups points to the same minimal importance, although they did not reach consensus: paediatricians gave an average rating of 1.4 (SD = 0.69) and generalists one of 2.35 (SD = 0.81).

4.3.30 Approach to neutropenia

Ratings for this subject were grouped around a value of 3, but only adult haematologists (rating: 4) and laboratory haematologists (rating: 3) reached consensus. The other ratings averaged 3.3 (SD = 1.1) for paediatricians, 2.4 (SD = 0.69) for laboratory haematologists, 3.4 (SD = 0.53) for students and 3.35 (SD = 0.74) for general practitioners.

4.3.31 Approach to lymphopenia

Consensus on the importance of this subject was registered only among adult haematologists (rating: 4) and interns (rating: 3). All the other evaluations revolved around an average of 3 (moderately important). Paediatric haematologists on average gave a rating of 3.4 (SD = 0.96); the laboratory haematologists' average rating was 2.5 (SD = 0.57); students gave a rating of 3.14 (SD = 0.53); and generalists one of 3.25 (SD = 0.78).

4.3.32 Leukaemia

While all other groups in consensus rated this subject as being essential, interns alone (although still in consensus) saw it as being only of moderate importance (rating: 3).

4.3.33 Lymphoma

Consensus was attained in all groups but a slight discordance occurred: for laboratory haematologists and interns, the appropriate rating was 3, while all others thought this was an essential subject.

4.3.34 Myeloma

While there was consensus within the groups, views on this subject were widely different: for the paediatricians it presented no importance as this is a disease of old age; for students and adult haematologists it appeared essential; for laboratory haematologists it was only moderately important, while the interns and general practitioners thought it was of minimal importance. If we exclude the paediatricians' view, justified as above, then we see the same pattern, where faculty and students ascribed to the subject a high value while the professional groups not connected with the faculty found that they, in practice, had very little to do with the disease. Indeed, should a general practitioner diagnose a myeloma, or only suspect this disease, the patient would be referred for specialist evaluation and treatment. Moreover, the relative low incidence of the disease makes seeing a myeloma patient in general practice improbable over many years.

4.3.35 Monoclonal gammopathy

Paediatricians never see this disease and therefore their rating was low (1: insignificant). Adult haematologists and laboratory specialists rated it as moderately important, whereas it had only minimal importance for interns (rating: 2). The students could not agree on their rating but their average was also 2 (SD = 0.73). General practitioners, too, did not agree on a rating: 1.8 (SD = 0.61).

4.3.36 Cytostatics

Haematologists could not agree within groups on the importance of this subject, but their averages were relatively high at 2.8 (SD = 1.2) for paediatricians, 2.4 (SD = 0.54) for adult haematologists and 3 (SD = 1.15) among laboratory haematologists. These ratings contrasted with the lower ones given by those groups who attained consensus: laboratory specialists and students rated knowledge on cytostatics as minimally important, and general practitioners, who never administer them, as insignificant (rating: 1). Cytostatics are a specialist / superspecialist subject and only an element of general medical knowledge for the general practitioner.

4.3.37 Blood components

All panellists agreed that the subject has maximum importance and gave an overall rating of 4 (essential).

4.3.38 Blood groups

There was consensus within all groups, however with considerable divergence among them, on this subject. General practitioners did not ascribe to it more than a minimal importance, while the other groups saw it as essential (rating: 4). The laboratory specialists alone gave it a rating of 3 (moderate importance). As a concept, blood groups are of major importance in many aspects of medicine, if only their association with certain diseases would be taken into account, for instance. They are crucial for the blood transfusion and transplant medicine; however, none of these are part of routine generalist practice.

4.3.39 Rh blood group

The rating for the Rh grouping was almost similar to that of the blood groups, with the exception that it was seen as moderately important by the adult haematologists this time, while laboratory haematologists saw it as an essential subject. General practitioners gave it the same importance as the blood groups, i.e. minimal.

4.3.40 Blood transfusion

This knowledge appeared as essential to all groups whose activity unfolds in a hospital, where transfusions usually are given. They ascribed to it a rating of 4, with the exception of the laboratory haematologists, who marked it with 3. General practitioners saw it as moderately important only, probably because they are rarely called to perform it, except when they work in a hospital.

4.3.41 Thrombosis

The paediatric haematologists could not agree on the importance of the subject but their ratings averaged 3 (SD = 0.66). The explanation may be that the paediatricians do not see thrombosis, as it is extremely rare in children. The other groups reached consensus. Laboratory haematologists too, saw thrombosis as a moderately important subject while all other groups thought it was essential knowledge. Thrombosis, a serious disease in practice and seen rather often, can be fatal and proper diagnosis and treatment are life-saving.

4.3.42 Anticoagulant therapy

Closely connected to thrombosis, anticoagulant therapy received the same treatment from the panellists: paediatricians could not agree on its value and their ratings averaged 2.7 (SD = 0.94). All remaining groups in consensus gave the same ratings they ascribed to thrombosis (see above at 4.3.41).

4.3.43 Hypercoagulopathy

The evaluations of this subject converged towards “moderately important”. Paediatricians, for the same reason shown in 4.3.41, again could not attain consensus here and their ratings averaged 2.3 (SD = 0.84), while all other groups were in consensus. Their rating of the subject was 3, with the exception of the students, who considered it as being essential (rating: 4).

4.3.44 Oncogenesis

A theoretical and complex subject, with no immediate practical application, oncogenesis was sanctioned as such by the groups not connected with the faculty: interns and generalists rated it at 1 (insignificant, for exclusion from the syllabus). The other groups did not come to a consensus but their group ratings averaged 2.4: paediatricians 2.5 (SD = 1.5), adult medicine haematologists 2.2 (SD = 0.83), students 2.3 (SD=1.0).

4.4 Conclusion

The survey generated a vast amount of data, as was expected to happen. Even with the use of the Delphi method, consensus was far from present in many instances, within the panels or between panels. Delphi makes it much easier to extract the significance from the answers, though, whereas the results of a simple survey would have had a daunting diversity. In the following chapter I will offer an interpretation of the results and compare the findings with the existing curriculum.

Chapter 5

DISCUSSION OF THE RESULTS

To arrive at the simplest truth requires years of contemplation. Isaac Newton

5.1 General

When analysing both open questionnaires and Delphi ratings, divergent opinions of faculty and practitioners on the relative importance of subjects were registered on numerous occasions. Haematologists and often the students, too, attached higher importance to subjects which were seen by generalists as minor, either due to their rarity or because they are not within the scope of activity of a general practitioner. This situation should not be surprising. While the practising doctors want fast and efficient diagnostic algorithms and clear management guidelines, their tutors seek to equip them with more in-depth understanding of the mechanisms of disease and with a comprehensive knowledge of medicine beyond that which would be seen daily in their rooms. This latter approach has a sound rationale behind it, namely the understanding of disease mechanisms, which is the basis for interpreting their sometimes very diverse manifestations and which further leads to more accurate diagnosis and to more adequate treatment. The history of medical education indicates that it follows a constant approach of learning first about the normal (i.e. anatomy, histology, physiology), then about the mechanisms of disease, and on this basis going to building up knowledge of the diseases themselves (Chapter 2, p. 35). Modern medicine, especially since Flexner's report (see Chapter 2, p. 34), has always followed this principle of backing up the clinical reasoning with basic scientific knowledge, in order to ensure that the interpretation of the clinical findings and the management of the patient are built on a sound scientific foundation. Beyond the domain of medicine, an application may be seen here of Bruner's concept that the teaching of structure is the basis for understanding reality (Chapter 2 p. 23).

The question is, though: how much should a generalist know about haematology, as, in fact, many conditions would be referred for management to a specialist or even a super-specialist? Here the answer seems to be that, apart for the fundamental understanding of the processes of

health and disease, the general practitioner should be able to establish a diagnosis. This must go along with the knowledge of the principles of treatment and of the factors governing the disease's prognosis. This kind of knowledge is structured in the often encountered curriculum item of "approach". However, if a haematological illness is usually managed at generalist level, the doctor must master all the required knowledge and skills.

5.2 What is the significance of the ratings obtained through the Delphi consultation?

The main goal of the Delphi consultation was to establish the relative importance of the subjects taught in haematology. In order to attain this objective, haematologists were asked to give their opinion on the value of the various subjects proposed to be part of the curriculum. The general practitioners and interns were asked to rate the same subjects according to their usefulness in practice. The students needed to give their usefulness estimation, of the subjects on the list, from the perspective of a further two years of clinical rotations after finishing the haematology module. Out of this chorus, the general practitioners' voice remains the strongest, as they are the main beneficiaries of the curriculum. It is therefore their opinions that will be considered first as we try to attribute values to the subjects. Corrections to these opinions need to be established keeping in mind the tendency of practitioners to disregard elements of knowledge that have no immediate practical value but which might be necessary for understanding the disease process, as discussed above.

Another important decision that needs to be made is related to the identification of those subjects which scored the highest and the lowest on the list: while those with the uppermost score deserve to be presented in rich detail in order to enable the graduate to manage them properly, those subjects which scored the lowest could be evaluated for exclusion from the curriculum. The subjects of highest value were identified by a score of 4 given by the general practitioners in consensus. The majority of the other groups also gave them a score of 4, and this concordance serves to confirm the significance of the subjects (see Diagram 5.1). Such items might be considered for more extensive presentation and might also be included in assessment tests.

Diagram 5.1: Curriculum subjects with the highest scores

Subject	Pediatric haematolo-gists	Adult haematolo-gists	Laboratory haematolo-gists	Interns	Stu-dents	GP
Microcytic anaemia	**4**	**4**	**4**	**4**	**4**	**4**
Iron deficiency anaemia	**4**	**4**	**4**	**4**	**4**	**4**
Splenomegaly	**4**	**4**	**4**	**4**	**4**	**4**
Lymphadenopathy	**4**	**4**	**4**	**4**	**4**	**4**
Thrombocytopenia	**4**	**4**	**4**	**4**	**4**	**4**
Pancytopenia	**4**	**4**	**4**	**4**	**4**	**4**
Haematological changes HIV/AIDS	**3 (0.81)**	**4**	**4**	**4**	**4**	**4**
Leukemia	**4**	**4**	**4**	**3**	**4**	**4**
Lymphoma	**4**	**4**	**3**	**3**	**4**	**4**
Blood components	**4**	**4**	**2**	**4**	**4**	**4**
Thrombosis	**3 (0.66)**	**4**	**3**	**4**	**4**	**4**
Anticoagulant use	**2.7 (0.94)**	**4**	**3**	**4**	**4**	**4**

1.....4 Rating of the importance of the subject

Consensus attained in the first Delphi round

Consensus attained in the second Delphi round

Consensus attained in the third Delphi round

2.5 (1.5) No consensus; mean of ratings and standard deviation given (in brackets)

It is appropriate to note here that ***the present research for the first time identifies the essential haematological knowledge for undergraduate study as defined by interrogating a number of practitioners in the field by means of a Delphi protocol***. To date, the most comprehensive study on the undergraduate haematology curriculum (Broudy 2007, Chapter

2, p. 50), found only that there was considerable confusion among the developers of curricula from 58 programmes in the United States, about the core learning objectives of the discipline. A general agreement, dictated by experience and common sense, on the essential knowledge areas of the discipline that would be required for generalist practice exists among specialists and includes the anaemic syndrome, the haematological malignancies and the haemostasis and its disorders (Diez-Ewald 2005). Beyond that, this research brings more clarity than anything published so far. As shown in Chapter 2, research has focused until now only on some aspects of the generalist's work: preventive care, the management of anaemia, the monitoring of chronic anticoagulation, care of cancer patients post-therapy (including palliative care), point-of-care testing and bleeding disorders.

A number of subjects were given a rating of 1 by the generalists, in consensus (see Diagram 4.1, page 98). When considering the opinions of the other groups on these items, two distinct situations were seen: sometimes the other groups' ratings did not attain a value of 3, and in such case the usefulness of the subject should be questioned. At other times, however, the other groups gave a higher rating of 3 or 4 to the subject, and these discordances should be analysed for two possibilities:

a) Either the subject is mainly relevant in the specialist domain and therefore was marked higher by the specialist groups; the consequence is that the matter does not need to be treated extensively in the haematology course, but in its essentials, or it might be included in an "approach". Such treatment would enable the general practitioner to diagnose the disease, counsel the patient in general terms and refer appropriately to the specialist.

b) Or it is a theoretical subject considered as being significant by the faculty members and as less important by the general practitioners. Here it is necessary to decide whether the subject would indeed enhance the capacity of the generalist to function properly and, if so, it should definitely be included in the curriculum.

Diagram 5.2: Subjects rated as not useful (1) by general practitioners

Subject	Pediatric hematolo-gists	Adult hematolo-gists	Laboratory hematolo-gists	Interns	Stu-dents	GP
Neonatal anaemia	**4**	**2**	**3.5 (0.57)**	**4**	**4**	**1**
Spherocytosis	**3.1 (0.99)**	**2**	**2**	**2.4 (0.51)**	**3**	**1**
Acquired platelet defect	**3**	**4**	**4**	**2**	**3**	**1**
Cytostatics	**2.8 (1.2)**	**2.4 (0.54)**	**3 (1.15)**	**2**	**2**	**1**
Oncogenesis	**2.5 (1.5)**	**2.2 (0.83)**	**2.5 (0.57)**	**1**	**2.3 (1.0)**	**1**

1.....4 Rating of the importance of the subject

Consensus attained in the first Delphi round

Consensus attained in the second Delphi round

Consensus attained in the third Delphi round

2.5 (1.5) No consensus; mean of ratings and standard deviation given (in brackets)

In Diagram 5.2, the first three subjects, i.e. neonatal anaemia, spherocytosis and acquired platelet defect, are managed at specialist / super-specialist level, thus the high scores given by those groups are justified. These scores should not, however, be interpreted as arguments for the importance of the subjects, as they indeed are not highly significant for the generalists. These subjects should rather be treated as described at a) above. The last two items, cytostatics and oncogenesis, were rated below 3 by most of the groups (with one exception, but not consensual). Instead of excluding them completely, though, they should be presented briefly and in general terms. It is perhaps the place to note here that a decision to exclude a topic from the syllabus might indeed be considered when there is consensus within all groups and agreement between groups on such exclusion. There was no such event in this study.

There were only 4 subjects concerning which most group opinions converged towards the value of 2: monoclonal gammopathy, myelofibrosis, secondary polycythaemia and hereditary platelet defects. A rating of 2 confers only minimal importance to the subject, according to the protocol of the Delphi method used in this study. Such items could, for instance, be proposed for self-study and would not be included in assessments. The remaining items on the list could be generally rated at 3; this approach acknowledges all situations where consensus was not attained and where discordance existed between the various groups. There is no need, however, to apply any mathematical formulas to try and reconcile all these differences: the subjects in this category can be treated in the same way. The curriculum should enable the graduate to understand their pathogenesis, to identify the main diagnostic features and to institute management or continue a treatment initiated at specialist level.

5.3 What is the significance for the curriculum of the themes identified in the open questionnaires?

a) Suggested outcomes

The analysis of the open questionnaires identified a number of outcomes of the training of a general practitioner, i.e. skills and knowledge considered to be highly useful for practice:

- The generalist should be able to perform a differential diagnosis of:
    - Anaemia
    - Neutropenia
    - Thrombocytopenia
    - Pancytopenia
    - Haematological changes in HIV infection
    - Lymphadenopathy
    - Bleeding, bruising
    - Thrombocytosis, hypercoagulation

- The generalist should be able to interpret the full blood count and clotting tests.
- He/she should know when a specific test would be indicated and should be able to use testing efficiently in a resource-poor setting;
- Should be able to use anticoagulants;
- Should know the main drug interactions which can occur in haematology;
- Should know what side-effects may be seen with chemotherapy and how to follow up a chemotherapy patient;
- Should be able to perform a blood transfusion, to identify complications and treat them;
- Should be able to perform bone marrow biopsy and fine needle aspiration (however, while generalists thought this would be useful, the haematologists held the opposite opinion);
- Should be able to identify the "red flag" signs of cancer;
- Should be able to perform side-room tests ("point-of-care" tests);
- Should know when to refer to a specialist.

As will be seen in the next division (5.4), these outcomes can be found in the existing curriculum, with the exception of the one regarding the need to identify the early signs ("red flag") of cancer properly.

b) Suggested methods

The main themes that crystallised from the open questionnaires delineated a number of methodological requirements for the haematology course:

- The need to structure the information in "approach" format, which would lead the doctor through a differential diagnosis, by starting from a few signs and by using the investigations in a rational fashion, and then would enable the graduate to master the management in detail (if it is within the generalist territory), or to counsel the patient

adequately on the management steps and on the prognosis, before referring to a specialist.

- The limited time allocated to haematology calls for a careful selection of the information; the insufficient clinical exposure needs to be compensated by frequent use of clinical material such as case histories.

- Small group sessions around simulated cases might be more effective than tutorials.

The lack of clinical exposure signalled by some of the panellists compounds the shortness of the course (only two weeks) and has the potential to alienate those students who assimilate the knowledge best when presented with concrete examples of disease. The North American survey by Broudy et al. mentioned in Chapter 2, p. 50 indicates how the programmes investigated dealt with the problem: by patient interviews in front of the class, case discussions in small group sessions, problem-based learning and reflection on the care of patients with haematological cancers.

Another possible way of compensating for the lack of clinical exposure might be the use of electronic case-based training, as described by Kraemer (2005), using dedicated software. The results obtained by this method are promising; however, to this day, and probably for a long time to come, nothing can replace the contact with the real patient. The history of medicine shows that the interaction with the patient was a constant in the training of doctors from the earliest known times (see Chapter 2 p.36).

c) Suggested topics

A number of subject groups were frequently designated as important for practice in the open questionnaires, and they, in fact, are those that scored the highest in the Delphi survey: anaemia; haematological changes in HIV infection; blood transfusion; and lymphoproliferative disorders. In general, however, the role of the open questionnaires consisted mainly in delineating a broad framework for the course and offering suggestions for its contents, whilst the relative value of the subjects was best defined by the ratings obtained through the Delphi survey.

d) Suggested methods of assessment

There were no direct suggestions of methods of assessment in the open questionnaires. The existing curriculum only provides a multiple choice question evaluation at the end of the two-week block. From the numerous suggestions underscoring the need to connect the contents of the course with the reality of the patient care, it seems more appropriate to use objective structured examination format questions for the final assessment (Prideaux 2007).

The importance of assessment for the outcome of any learning process is by now well known. Students learn with the exams in mind and for the exams. As Fallon (2006) put it, "...the assessment reinforces learning and is the senior partner in learning and teaching. Get it wrong and the rest collapses." When planning the course's final examination, the list of items to be examined must contain those units of content which are essential for the practice of the graduates. These can be identified from the results of the Delphi process, as shown in this study. The choice of assessment method, however, is not necessarily left to the Delphi panellists: their "expertise" may not be that specialised. At the most, a number of curriculum experts may be surveyed on the matter (by using Delphi or not). The assessment methods also depend on the available expertise and time of the course team.

It is interesting here to look at the results obtained by Fallon (2006) when asking specialist haematologists, examiners, non-registrars and registrars to rate their preference for the methods of assessment in the haematology in a sports medicine postgraduate program. The registrars gave the highest ratings to the examination methods employed by the college, for which they were preparing. The other groups had completely different views.

5.4 Comparison of the haematology curriculum at the Faculty of Health Sciences, Stellenbosch University, in the light of the results of the Delphi survey

In this section, the 2009 curriculum for the Haematological System at the Stellenbosch Faculty of Health Sciences (Dippenaar *et al.*, 2009) will be examined, chapter by chapter, in order to identify gaps that exist in the prescribed teaching when compared to the findings of the Delphi survey and the extent to which the curriculum should change in order to include the survey suggestions. It should be acknowledged at this point that the existing curriculum is the result of a sustained effort by a number of specialists with experience, who have meticulously weighed every detail. Without doubt, the result is a comprehensive programme,

meant to provide the graduate with the knowledge required to handle haematological health issues in practice. But, in the absence of a stakeholder needs analysis, one is left to wonder whether the present curriculum is biased or not – and if it is, then to what extent – by the unavoidably distinct view of the specialists on the choice of subjects, outcomes and teaching methods.

The curriculum is structured around six themes: anaemia; bleeding tendencies; cytopenias and cytoses; haematological malignancies; blood typing and transfusion; and thrombotic conditions. For each theme, an aim is defined, as well as outcomes which indicate what the student should be able to do at the end of the training period. The required background knowledge, which the student should review before the start of the theme, as well as the resources, consisting mainly of textbook chapters, are indicated. The activities related to the themes are structured in sessions. There are between four and eight sessions for each theme. These include lectures, directed self-study and tutorials. The self-study is guided by questions and case studies to which the learner should answer after consulting the suggested material. Lectures are given on the main subjects within each theme. The total duration of the module is two weeks. The final examination consists of multiple choice questions.

5.4.1 Theme 1: Anaemia

The present haematology curriculum sets the following aim: “at the end of the theme the student should know what the term ‘anaemia’ means and encompasses, recognise the most common and clinically relevant types of anaemia, be able to diagnose this from the symptomatology, clinical and basic laboratory investigations and be able to treat and refer appropriately” .

The desired outcomes for the learner are:

- Know the normal values of haemoglobin and red cell related blood values in adults and children and know that the values in neonates and children differ according to age.
- Know the commonest causes of the different anaemias, i.e. a simple working aetiological classification of anaemia.

- Integrate the clinical classification of an anaemic patient with the FBC result; know how to differentiate between the different types of anaemia on the basis of the red cell indices (morphological classification) and determine the cause of the anaemia by requesting appropriate further basic laboratory and special investigations.
- Recognise a haemolytic anaemia and know how to integrate the cytological and biochemical consequences of haemolysis with the clinical picture.
- Have thorough knowledge of the target group patients that present most commonly with a specific anaemia.
- Be able to manage and treat the most common anaemias seen in practice, know when to transfuse and know when to refer appropriately.
- Know when to refer a patient urgently.

The existing curriculum comprises seven lectures of 45 minutes each on various aspects of anaemia:

- Definition, aetiological and morphological classifications, pathogenesis, laboratory investigations
- Approach to the tired, pale patient
- Iron deficiency anaemia
- Approach to the patient with haemolytic anaemia
- Inherited and acquired haemolytic anaemia
- Folate and vitamin B12 deficiency
- Normal values, target groups

The lectures are complemented with a tutorial on the interpretation of the full blood count.

Anaemia is identified in the literature as the most frequent haematological pathology seen in general practice. It is estimated that around 40% of the world population may suffer from anaemia (Ahluwalia 2002, Huisman 2007), with most of the condition being seen in the developing world.

The great importance of anaemia in general practice is reflected in the frequent mentioning of the disease in the open questionnaires, as well as in the high ratings given to subjects related to it in the Delphi rounds. The analysis of the Delphi results suggests a possible change in the area of haemolytic anaemias. There are two lectures on haemolytic anaemias, one outlining the approach and the other one dealing with the various diseases falling under this heading. The panellists in general allocated a rating between 3 and 4 to haemolytic anaemia, meaning that they considered it to be an important subject. However, some entities within the chapter, such as spherocytosis, thalassemia and sickle cell anaemia were rated as unimportant or of little significance by the general practitioners. These diseases are rarely seen in South Africa and then mainly in immigrants and their descendants (Poole 1989). It may be necessary to review the time allotted to the chapter or maybe only the relative extent to which some diseases are presented, in order to discuss the pathology which is usually seen in South Africa more extensively. An example of such disease may be haemolytic anaemia due to malaria. This modification would not have any impact on the outcomes of the theme, which remain unchanged.

5.4.2 Theme 2: Bleeding tendencies

The general aim of this theme is to give the student "a thorough knowledge of the most common and most life-threatening bleeding conditions. The student should know the basic clinical difference between platelet and clotting anomalies, and the basic laboratory investigations needed to confirm this. The student should know and be able to apply the guidelines for the emergency treatment of bleeding tendencies and know when to refer (urgently)".

The outcomes desired at the completion of training are:

- Know normal values: platelet count and sizes, clotting times, prothrombin time, partial thromboplastin time, thrombin time, fibrinogen.
- Understand and be able to interpret the association between different clotting times and clotting cascades.
- Be able to differentiate between a platelet defect and a clotting defect on both clinical and laboratory levels.

- Know when to suspect a bleeding tendency in a child, how to examine the patient so that appropriate laboratory investigations can be requested.
- Know the pathogenesis and clinical picture of congenital and acquired bleeding tendency and know the principles of treatment.
- The most important platelet deficiencies and platelet defects: understand the pathogenesis, know how to treat the patient, the principles of therapy and when to refer the patient appropriately.
- The most important inherited and acquired clotting defects: understand the pathogenesis and know how to make the clinical and laboratory diagnosis, know the therapeutic principles and know when to refer the patient appropriately.
- Have a thorough knowledge of the emergency conditions associated with bleeding tendencies; know the causes, diagnosis and treatment thereof.
- The curriculum provides for five lectures under this theme:

➢ Classification, clinical aspects, laboratory investigations

➢ Approach to a patient with a bleeding tendency

➢ Emergency conditions: disseminated intravascular coagulation, massive bleed

➢ Hereditary and acquired platelet defects

➢ Hereditary and acquired clotting defects

➢ Directed self-study on clinical cases and a tutorial on interpretation of clotting tests complete the session.

Compared to anaemia, there are far fewer mentions of bleeding disorders in the open questionnaires, as an indication that this theme plays a lesser role in the daily activity of a general practitioner. The entities mentioned are: approach to thrombocytopenia, immune thrombocytopenia, approach to pancytopenia, approach to bleeding, haemophilia and the approach to bruising (see Table 4.1). The Delphi ratings allotted maximum importance to thrombocytopenia and pancytopenia and somewhat less importance to the approach to the bleeding child (see Diagram 4.1). The hereditary platelet defects and acquired platelet defects scored low in importance, probably due to the fact that they are not only rare, but require

more specialised testing for diagnosis. The way this may reflect onto the curriculum is that the space presently destined for teaching hereditary and acquired platelet defects should be reviewed. Notwithstanding this, bleeding pathology remains among the main subjects of the curriculum, as they are seen relatively often and their severity potential is considerable (Colon-Otero 1991; Scott 1993).

5.4.3 Theme 3: Cytopenias and cytoses

The 2009 curriculum formulates the following aim for this theme: "The student should be able to recognize cytopenias and cytoses, make an appropriate differential diagnosis and know when to suspect a disease of the bone marrow and how to manage a patient appropriately".

No less than ten outcomes should be attained by the learner after working through the theme:

- Know the normal values of the full blood count and differential white cell count in adults so that you are able to recognize cytopenias and cytoses.
- Know the most important causes of a neutrophilia, eosinophilia, monocytosis and lymphocytosis. Know when to suspect a malignant condition and when to refer for further investigations.
- Be able to recognise polycythaemia and to investigate the patient in order to establish the aetiology (primary or secondary polycythaemia).
- Know which patients can be treated by you and which should be referred.
- Make a differential diagnosis for a thrombocytosis. Know when to suspect a myeloproliferative disease and when to refer for further investigations.
- Know the most important causes of neutropenias and lymphopenias. Understand the clinical importance thereof and know how to manage it or to refer.
- Define pancytopenia and have a thorough knowledge of the causes of a pancytopenia. Be able to identify the condition and refer for a bone marrow investigation.

- Know the difference between pancytopenia and aplastic anaemia, diagnose aplastic anaemia and know the important investigations and appropriate referral.
- Know the basic structure and function of the spleen, how to approach the problem of a patient with splenomegaly. Know how to manage a patient who is referred back to you following splenectomy.
- Know the haematological complications of HIV infection, as well as the role of secondary (opportunistic) infections and antiretroviral therapy in cytopenia.

A number of five lectures were planned, in order to cover most of the essential information:

- Approach to a patient with an enlarged spleen: definitions, causes, normal values
- Primary and secondary polycythaemia, thrombocythaemia and thrombocytosis, myelofibrosis
- Approach to the patient with a pancytopenia: differential diagnoses, aplastic anaemia
- The haematological changes of HIV/AIDS
- Approach to the patient that is very prone to infections
- Neutropenia, pancytopenia, thrombocytopenia and polycythaemia appear as items valuable for generalist practice in the answers to the open questionnaires. Highest ratings were given to: approach to splenomegaly, approach to thrombocytopenia, approach to pancytopenia and haematological changes in HIV/AIDS. Neutropenia and lymphopenia scored an average of 3, which indicates their significance in practice. Indeed, such changes are rather frequently seen, in association with autoimmune, myelodysplastic or myeloproliferative pathology (Rodak 2007). Other subjects are most probably less seen in generalist practice and did not obtain high scores. These were thrombocytosis, aplastic anaemia and myelofibrosis. It would appear, from the comparison between these ratings and the structure of the curriculum that this chapter is well balanced and corresponds to the needs of practising generalists.

5.4.4 Theme 4: Haematological malignancies

The aim of the theme was to foster a "broad understanding of the main groups of haematological malignancies and know at which ages these main groups typically present. ... should also know how a haematological malignancy can present, how to differentiate this from other diseases and malignancies, what emergency investigations should be done and how to refer the patient appropriately"

After completing the theme, the student should be able to:

- Know theoretically how to carry out a thorough clinical examination, especially an abdominal examination, and to perform a general lymph node evaluation. Know when to suspect a haematological malignancy.
- The student must know the normal values of the full blood count, total white cell count, neutrophils and lymphocytes in adults. Be able to interpret the full blood count and know how to correlate this with the clinical picture.
- Understand the basic differences between leukaemia and lymphoma with regards to the pathogenesis and clinical presentation.
- Understand and know the basic differences between acute and chronic leukaemia with regard to the pathogenesis, clinical presentation and baseline laboratory findings, and know how to differentiate between myeloid and lymphoid types.
- Know which other appropriate supporting / screening tests should be requested when there is a suspicion of haematological malignancy.
- Have a good knowledge of the clinical findings, radiological picture and basic biochemical investigations so as to recognise a myeloma.
- Know when to refer a patient appropriately
- The lectures for the Haematological malignancies theme included:

➢ Approach to the patient with enlarged lymph nodes, lymphoma and lymphadenopathy

➢ Lymphoma and lymphadenopathy

➢ Introduction to oncogenesis: pathogenesis, pathology and laboratory investigations

- Basic knowledge of cytostatics
- Approach to the patient with leukaemia
- Myeloma and monoclonal gammopathy

"The role of chemical pathology in the diagnosis of haematological disease" was designated to be discussed in a tutorial.

Knowledge about haematological malignancies is without doubt part of the core training areas of a general practitioner (Prasad 2008; McGrath 2007, Léger 2004). Early signs, screening tests, specific clinical presentations, diagnostic tests and appropriate referral form the essential chapters of this area. However, the general practitioner would not treat these cancers, as the knowledge, the equipment, the drugs and the adjuvant therapies, as well as the monitoring, are in the domain of competence of a specialist and, ideally, of a super-specialist haematologist-oncologist. This reality is reflected in the answers to the open questionnaires, where "approaches" are proposed to leukemia, to lymphadenopathy and to leukocytosis. The Delphi ratings of leukemia and lymphoma are maximal (4), while myeloma only received a valuation of 2 from the general practitioners, although adult haematologists, laboratory haematologists and students saw it as much more important (see Diagram 4.1).

The theory on cytostatics and oncogenesis did not seem to be useful to the generalists and they rated it at 1; the scores given by other groups mostly lacked consensus, but their averages did not attain 3. This opinion was echoed by the haematologists, who proposed in the open questionnaires that the following subjects should be excluded from the curriculum: oncogenesis; cancer genetics; mechanisms of action of cytostatics and cytostatic protocols; bone marrow aspiration and biopsy; fine needle aspiration; and details on bone marrow transplant requirements.

The above findings suggest that the provision for a whole lecture on cytostatics, doubled by another full lecture on oncogenesis might need to be reconsidered and more space possibly given to subjects such as early signs, screening methods and appropriate referral, which are closer to the sphere of activity of a general practitioner.

Among the outcomes suggested in the open-ended questionnaires was the correct identification of the "red flag" (i.e. early) signs of cancer; this is not included in the existing curriculum, although it is a highly useful skill, as an early identification of a cancer is a

condition for a better survival (Rossbach 2005). The literature suggests another area that needs to be covered by the curriculum, which the present programme does not mention: monitoring of haematological cancer patients after therapy and palliative care, including pain management (Zernikow 2008, see Chapter 2 p. 51).

5.4.5 Theme 5: Blood typing and transfusion

The 2009 curriculum sets as aim for the theme that the student should understand "the basic transfusion serology, know and be able to use the most important blood components appropriately and be familiar with the adverse reaction and ethical aspects of transfusion medicine".

The outcomes outlined are:

- Understand the basic principle and clinical importance of cross-matching.
- Understand the transfusion principles in patients with Rh-negative status.
- Be familiar with the different blood components available and know the appropriate indication for prescribing each.
- Have a thorough knowledge of adverse immunological reaction that can occur with the various blood components. You must be able to recognise this reaction clinically and treat it appropriately, and you must be aware of and know about the most important precautionary measures that can be implemented to prevent it.
- Know the practical aspects of safely requesting and administering blood products.
- Have a basic knowledge of the ethical and legal aspects of transfusion medicines.
- The basic information on transfusion should be conveyed in four lectures:

  - Basic principles of transfusion, cross-match
  - Blood components, indications
  - Blood product administration, medico-legal aspects

- Administration of blood products, dangers of transfusions, management of adverse reactions

Blood transfusion might not be performed often by general practitioners; however, those who do emergency room work may well administer blood. The item appeared frequently in the responses to the open questionnaires, especially in the non-specialist groups. The Delphi questionnaire returned generally high ratings for the subjects related to transfusion: blood components scored 4, blood transfusion 3, while blood groups and Rh were surprisingly rated at 2 by the general practitioners (the other groups gave higher ratings). Blood transfusion remains an especially important subject in the South African environment where motor vehicle accidents and violent crime are relatively frequent (Field 2007; Bateman 2004). The curriculum provides the essential knowledge related to this subject and the results of the Delphi process did not suggest any changes to this theme.

5.5.6 Theme 6: Thrombotic conditions

The aim of this theme, dealing with a major condition, is described as follows: "After completing the theme, you should know how to objectively diagnose and appropriately treat deep venous thrombosis or pulmonary embolism (or thrombosis / thromboembolism at other unusual sites) and know how to investigate these patients (and their families) appropriately for thrombophilia and treat them in practice."

The outcomes proposed are:

- Know when to clinically suspect deep venous thrombosis or pulmonary embolism (or thrombosis / thromboembolism in other unusual locations).
- Know how to diagnose this objectively.
- Know how to treat the patient appropriately in the acute phase.
- Know the laboratory investigations and their interpretation for monitoring heparin or warfarin therapy.
- Be aware of the dangers of heparin and warfarin therapy.
- Know how and when to follow up the patient.

- Have a working knowledge of the underlying causes of thrombotic tendencies, especially in young people (thrombophilia) and know how to investigate these patients (and their families) appropriately.
- Know how to advise and treat the patients (and their families) in practice.
- The lectures provided are:

➢ Approach to the patient with thrombosis, hypercoagulability, causes, hereditary and acquired.

➢ Anticoagulant therapy

➢ This is a rather small chapter of pathology, but of high significance, as thrombosis is a frequent event and has lethal potential, due to embolisation (Rodak 2007). Both thrombosis and the use of anticoagulant medication were rated by the Delphi panellists as having the highest importance, while hypercoagulopathy was rated 3 (moderate importance). This theme is well structured and its extent is adequate to the knowledge that needs to be transmitted. There was no Delphi finding suggesting a revision here.

5.5 Summary of the comparison of the existing curriculum with the findings of the Delphi survey

As stated at the beginning of this chapter, the undergraduate curriculum in haematology at the Faculty of Health, University of Stellenbosch, is the result of a thorough process of planning, which takes into account the past experience in teaching haematology at Stellenbosch, the requirements for accreditation with the Health Professions Council of South Africa and the scientific literature. Nevertheless, the Delphi survey of a number of haematologists, most of them in academic institutions, as well as of students, interns and general practitioners, revealed discrepancies between their opinions and the existing curriculum. The discrepancies revolved mainly around the relative importance of some subjects, whose coverage, according to the panellists, is disproportionately large when compared to their value for the generalist practice. These subjects are: spherocytosis, thalassemia, sickle cell anaemia, hereditary platelet defects, oncogenesis and cytostatics. While these subjects should not be excluded, the emphasis given to them might be reduced and more time and resources could be allocated to

other, more frequent health issues such as anaemia, secondary to malaria, or the haematological consequences of the HIV infection.

The findings of this research prove the usefulness of a broad consultation in the process of curriculum building. Such consultation is perfectly feasible, even if the experts are dispersed geographically, by means of a Delphi survey.

5.6 Using the Delphi method in the process of curriculum development

The literature has registered numerous reports of the use of the Delphi method in order to determine the core contents of a curriculum. The broad consultation enabled by the method makes it possible not only to draw up a list of items of knowledge and skills that is grounded in the reality of medical practice, but also to establish the relative importance of the subjects taught for the formation of the future practitioner.

The choice of the panel in this research included all the groups of professionals who were involved with the haematology curriculum, either as trainers or as learners, or as beneficiaries of the training who went on to apply the knowledge and skills acquired in practice. The varied participation ensured a multi-faceted appraisal of the curriculum, thus enhancing the validity of the study. One group of beneficiaries of the haematology curriculum whose opinions were not solicited were the patients. In actual fact, the beneficiaries of the medical act, and by the intermediary of it, the beneficiaries of the curriculum, are the sick people. It must be accepted, however, that the patient is an expert only in regard to his or her own experience of the particular disease and the way the interaction with the medical system helped to cure the particular illness. Patients were therefore mainly involved in Delphi studies of curricula destined to address a single disease (Alahlafi 2005).

While there is mention in the literature of analysing the answers to the open questionnaires manually in order to extract the main themes, this research has demonstrated that it is possible to apply the method of coding in order to extract the meaning of these answers. Using a well-defined and tested method contributes to enhance the validity of the results.

By establishing the consensus level at 80%, a clear indication was obtained of the opinions of the panellists. Other approaches would have been to use a lower percentage limit, for instance, anything over 50%, but then the characterisation of the opinion of the panellists

would have been much fuzzier. There is no prescription in the literature regarding the definition of the consensus; however, most of the studies published tend to use a cut-off point of 75 to 80%. In the case of groups constituted of only four participants in this study, the threshold of consensus was established at 75%, i.e. 3 out of 4, while for all other groups it was 80%.

It is tempting to consider the panellists as a single large group and to process all answers together. This approach, however, silences the opinions derived from the specific experience of a given professional group, favouring a compromise whose result is irrelevant for the curriculum developer. Hanafin (2004:24) discussed the advantages and disadvantages of each approach in detail. Most studies which involved various groups of experts analysed their opinions separately, while nevertheless considering the significance of consensus inside the group. Groups that attained internal consensus on the value of a specific item of the curriculum may have divergent opinions from each other and the significance of the divergence needs to be explored, as it adds richness and value to the final decision.

The lack of consensus, however, is also significant. The mean value of the ratings indicates the trend in the opinions of the panellists, while the standard deviation is a measure of the magnitude of the divergence in opinions, and therefore an indicator of the strength of the group opinion, even if it has not attained the level of strength defined as consensus. Knowing the trend and strength of the group opinion can also inform the curriculum makers in their choices (Linstone & Turoff 2002:80-97).

A last global look at the value of the Delphi method for establishing the content of the curriculum in haematology does register the following: if it is incontestable that broad consultation is the best way in which a decision can be taken on the content of the curriculum, then the Delphi method is possibly the best suited instrument for eliciting the opinions of the various groups of stakeholders and offering a valid synthesis of those opinions.

Chapter 6

CONCLUSIONS

Believe those who are seeking the truth; doubt those who find it. Andre Gide

6.1 Introduction

The undergraduate haematology curriculum at the Faculty of Health Sciences, University of Stellenbosch, was scrutinised from a great diversity of angles and by numerous arbiters, and their opinions were structured by means of the Delphi method. The quintessence of the diverse meanings was then compared with the existing curriculum and significant differences were found. This chapter first deals with the conclusions that can be drawn from the research, regarding the suitability of Delphi as a method of collecting and consolidating the opinions of the stakeholders in the process of curriculum development. The particularities of applying the method for this particular purpose, as they gradually revealed themselves during the research, are discussed. The second part of the chapter summarises the suggestions toward a framework for a new undergraduate curriculum in haematology, based on the findings of the Delphi process.

6.2 The Delphi method was efficient in structuring a broad consultation of the stakeholders in the curriculum

The main advantage of the Delphi method is the facilitation of consensus in a consultation of specialists.

a) *It is feasible to organise a Delphi consultation, without excessive use of resources*

In this research, a number of 63 participants in the educational process were consulted. Their geographical locations were spread widely across the country; however, by using electronic mail, it was possible to communicate with them repeatedly, at a minimal cost. The duration of

the whole process was a little longer than three months, from sending out the invitation to participate in the study to the receipt of the last completed form.

b) ***The choice of panel members must be representative for the groups involved in the educational process, as well as for the graduates of the programme, who are applying their training in practice.***

For the purpose of this study, the criterion for identifying an "expert" who could participate in the survey was present or past participation in the haematology curriculum at Stellenbosch Faculty of Health. The groups invited were haematologists (adult haematologists, paediatric haematologists and laboratory haematologists), students, interns and general practitioners. The nature of the research precluded the surveying of patients, although, as beneficiaries of the activity of their doctors, the patients are also indirect beneficiaries of the curriculum. However, patients are experts mostly in the way their particular disease impacts on their lives and how it responds to various treatments; a large number would have been required in order to cover all haematological pathology.

The participation of graduates who are in generalist practice is essential, as they are in the best position to evaluate how well the curriculum prepared them adequately to diagnose, treat and refer haematological patients.

c) ***The main advantage of the Delphi method over other forms of expert consultation is the facilitating of consensus; this was seen in this study too.***

The progression of consensus within groups was substantial from one round to the next, with most progress taking place in the second round, reinforcing the findings of Linstone and Turoff (2002). The definition of consensus as 80% of the participants being in agreement allows for a better description of the opinion of a group than when the percentage is set at just over 50%.

The answers were not considered all together, as this would not have allowed for reflecting the specific expertise of each group with regard to the curriculum. In the quest for middle ground, Delphi would have silenced divergent opinions resulting from a group perspective and would have returned less relevant results.

d) ***The open-ended questionnaires can contribute more valuable and diverse information on the curriculum than the simple proposal of subjects to be taught.***

Most applications of the Delphi method in the process of curriculum construction use the open questionnaires to obtain items that should be included in the syllabus. In this study, the analysis of the answers following the principles of the coding technique did reveal much more complex information. The data obtained were valuable for the further steering of the Delphi process or directly informed the curriculum analysis.

6.3 The extensive consultation of teachers, learners, specialist haematologists and general practitioners enhanced the relevance of the curriculum content for general practice

In the process of planning the curriculum, the identification of the content to be taught, which indeed is relevant for the generalist practice, would benefit from consultation with all parties involved, including the actual beneficiaries of the learning process, the established professionals. This study has shown that an extensive consultation, structured by the Delphi method, was useful not only in defining the outcomes and content of the haematology curriculum but also in establishing which subjects should constitute the core of the course and which ones in fact are marginal. Furthermore, the consultation clearly defined the demands made by the general practitioners on a haematology training programme:

- The presentation of clinical information in the form of "approaches" in order to facilitate differential diagnosis, which is the most frequent task of the generalist in her post at the frontline of health care
- More comprehensive teaching and learning should be reserved for diseases that will be treated at generalist level, and comparatively less space should be allocated to diseases that will always be referred to a specialist.
- Emphasis on simple diagnostic tests which can be done in the consulting rooms.
- Emphasis on early signs of disease, especially of cancer.
- Trimming down the pathophysiology information to that which is strictly necessary.
- Providing only the core information on diseases that will be seen rarely.

While these requirements may raise contra-arguments and may constitute the subject of further debate, the merit of the consultation is that of bringing them to light in a very precise

form. They are authentic, as they are formulated directly by the participant general practitioners: this eliminates "second-guessing" by specialists not involved in primary care. ***This research brings to light, for the first time in the literature, outcomes and content for an undergraduate haematology course that are the result of a broad consultation of the people creating and teaching the curriculum and those using it in practice.***

6.4 Suggestions towards a framework for a new undergraduate haematology curriculum

It was repeatedly stressed in this study that the undergraduate haematology curriculum at the Faculty of Health, University of Stellenbosch, was prepared with utmost care by a group of haematologists, assisted by a general practitioner. This committee worked within the guidelines drawn up by the Faculty, with attention to the requirements for accreditation of the Health Professions Council of South Africa and to international norms. This study found a number of discrepancies between the existing curriculum and the findings of a Delphi survey of various professional groups gravitating around the curriculum: specialist haematologists, students, interns and general practitioners. On the basis of the found differences, suggestions towards a new curriculum were formulated.

6.4.1 Outcomes

The overarching outcomes of the undergraduate haematology curriculum indicate that, at the end of the course, the future general practitioner should be able to diagnose the various haematological diseases (or at least to circumscribe the diagnosis before referring the patient for specialist investigation); to treat or refer the patients appropriately; to follow up patients correctly when they are discharged from specialist care; and to identify and manage haematological emergencies adequately.

Learning area outcomes should be established in agreement with the overarching outcomes, for every group of haematological diseases. These outcomes, as formulated in the existing undergraduate haematology curriculum at the Faculty of Health Sciences, University of Stellenbosch, have been analysed in the "Discussion" chapter of this study. They were found to be in agreement with the data provided by the stakeholders' consultation. The only

exception seen was the need to introduce an outcome related to signs enabling early diagnosis of haematological cancer.

6.4.2 Content

It was seen clearly, from the analysis of the survey data, that the curriculum committee and general practitioners had divergent philosophies regarding the curriculum content. The haematologists indicated that a substantial knowledge of physiology, anatomy, histology and physiopathology should be included in the course, in order to enable the future graduates to understand the underlying processes of disease and healing. The general practitioners were mainly interested in the practical aspects of identifying the disease and dealing with it and would have liked to see the scientific details reduced to a minimum. The question of content was made even more critical by the fact that duration of the entire programme was, and still is, only two weeks.

This sort of conflict of opinion is typical and has often been documented over time in medical schools. A certain scientific foundation is absolutely necessary for the practice of medicine and for assimilating the elements of progress in the field. The limited time, in the case studied, does not allow for a thorough revision in lectures of the fundamentals of haematological science. Moreover, much of the ground would have been covered already in the first years of study. It is more convenient, therefore, to provide self-study guidance and tutorials to review the basic scientific aspects, than to present them in lectures.

6.4.2.1 Core content of the haematology course

A number of subjects were identified by all Delphi participants as being of paramount importance for an efficient generalist practice. These were:

- Iron deficiency anaemia / microcytic anaemia
- Approach to pancytopenia
- Approach to thrombocytopenia
- Haematological changes of HIV/AIDS
- Approach to splenomegaly
- Approach to lymphadenopathy

- Leukaemia
- Lymphoma
- Blood components and transfusion
- Thrombosis and anticoagulant therapy

These subjects might be given preferential treatment within the curriculum, with sufficient contact time, and might form a permanent component of the assessments, too.

6.4.2.2 Subjects of minimum importance

As opposed to the previous list, these subjects were, in fact, proposed by the panellists for exclusion from the course, due to their minimal significance for the generalist practice:

- Neonatal anaemia
- Spherocytosis
- Acquired platelet defects
- Cytostatics
- Oncogenesis

However, as only the general practitioners attained consensus on the low value of these subjects, while other groups either rated them higher or could not arrive at consensus, their fate should be considered with care and they probably deserve a minimal place on the content list of the course.

6.4.2.3 Subjects of moderate importance

Most subjects fell under this category, which includes, for practical purposes, all ratings of 2 and 3. The distinction that applies within this group is that emergencies, as well as diseases for which the general practitioner would be called to treat them herself, should be given more curriculum time than those diseases which, after a preliminary diagnosis, would only be referred to the specialist. Another, not less important distinction is that early signs of haematological malignancies (“flag” signs) should be given special attention.

6.4.3. Curriculum review

How often should the curriculum undergo a revision? This depends on its continued relevance to the training of the future practitioners and on the rapidity of change in the particular speciality. The relevance to the training can be assessed on a regular basis by Delphi surveys of the graduates who have gone into general practice. The change in the speciality is best evaluated by the specialists themselves. A yearly reckoning session of the curriculum committee is necessary in order to make smaller adjustments whose necessity might be revealed by student feedback or to adapt to time or personnel constraints. Many essential textbooks, as traditionally in paediatrics, for instance, are updated every five years. This time interval presumably is sufficient for new research in the specialty to emerge and also for gaining some perspective on such new information. Every five years, arguably, it may be necessary to re-evaluate the lecture material, bibliography and teaching and assessment methods. Such opportunities may be used to do a broad consultation similar to the one conducted in this study, in order to do thorough assessment of relevance of the course to the activity of future doctors.

6.4.4. Limitations of this study

The paradigm of the curriculum design method in medical school, including the approach proposed by the Johns Hopkins group, is that of the scientific method conceptualised by Bobbitt and Charters (see Chapter 2 p. 21). The limitations of their system implicitly apply to the curriculum in haematology as delineated by the results of this study. They consist here mainly in the fact that, while focusing on the outcomes, potentially useful knowledge or valuable educational issues spontaneously arising during the student-tutor interaction will not be given any attention. Addressing this limitation was not within the scope of this study. In principle, such issues might surface during the evaluation of the curriculum and they should be given due consideration by the curriculum revision team.

The general needs analysis and the learner needs assessment, as proposed by the Johns Hopkins group, are much more extensive that the analysis performed in this study. For instance, the curriculum designers should, according to the vision of Kern and collaborators, look at the published literature on the curriculum in question; at accreditation standards; at

documents submitted to clearinghouses; at similar curricula from other faculties; etc. (see Table 2.2, page 43). They go as far as to say that, if the curriculum developers have completed all the steps mentioned above, and also consulted a number of specialists in the domain, the information collected would suffice to formulate the curriculum, without the need to consult the practitioners in the field and other stakeholders. They bring no evidence to support that statement. This may be the time to remember that the concept of needs analysis itself was criticised as unnecessary effort, as teachers usually know from experience and intuition what content needs to be included in the curriculum (Chapter 2 p. 41). By comparing the findings from the Delphi survey with the existing curriculum, this study explores exactly this as yet unexplored area. This is, however, not a needs analysis in the terms of Kern and collaborators. The aim of this study was, from the beginning, to use the Delphi method in order to obtain sufficient information from a number of stakeholders to ensure that the undergraduate haematology curriculum is anchored in the reality of generalist practice and not in the system of perceptions and concepts of the curriculum committee.

Kern et al. (1999) suggest ten methods which could be used to collect information from the stakeholders in the curriculum (see 2.5, Table 2.2, page 43). The Delphi method is only one of these, along with focus groups, nominal group technique, direct observation of doctor activities and others. These modalities of performing a needs assessment are complementary and, should they be used in combination, would undoubtedly generate a more realistic and comprehensive picture. Then, again, they are time-consuming and resource-intensive by comparison with Delphi.

The main disadvantage of Delphi is that the panellist is offered a menu or a list of items out of which she or he has to choose, or which need to be prioritised or rated. Should the participant want to propose an item which does not appear in the menu, she or he are invited to formulate it in writing at the end of the questionnaire, but there is no way of ensuring that it would be indeed done and this may result in loss of potentially valuable information. In my study, this disadvantage is counterbalanced by using open-ended questionnaires at the beginning of the survey, where the participants could expose their opinions in a more unrestrained way. However, in such self-administered questionnaires, certain lines of thought may not be followed exhaustively; again, valuable information may be lost. Other techniques, such as focus groups or in-depth interviews, may be required in order to explore the participants' opinions fully. I decided not to use such methods here because their intensive

nature limits the numbers of experts and thus reduces the possibility of validating their personal opinions by corroborating with other panellists' views.

While Delphi provides ratings of importance of the subjects, there is no simple algorithm that can be devised in order to deal with the divergence of opinions between the various professional groups surveyed. They need to be interpreted with the necessary insight.

The results of this research are based on the analysis of the undergraduate curriculum in haematology at the Faculty of Health sciences at the University of Stellenbosch. While the findings do indeed apply only to this particular case, the method and the procedure followed for interpreting the results are certainly applicable to any curriculum in clinical sciences, at any faculty.

6.4.5. Directions for further research

The general aim of curricular research is to ensure that teaching stays relevant to the needs of the society and that the methods used are best adapted to transmit the knowledge and mould the future practitioners. Further research resulting from the findings of this study may aim at establishing guidelines for a needs assessment as the basis for designing medical curricula and determining the role of the Delphi method in such a process. Refining the criteria for recruitment into the panel of experts; evaluating the usefulness of combining interviews with the Delphi method; the optimal timing and modality for student feedback; and the frequency of curriculum evaluation may constitute further directions of investigation. The methods tested in this study and some of the trends revealed might be further researched and adapted for curriculum development in other medical disciplines.

6.4.6. A few personal thoughts after finalising this study

The effort required by the execution of this research was rewarded not only by the satisfaction of having filled a small gap in the knowledge on haematology curriculum design: During the long months of slow and meticulous labour, I was progressing along an exciting path of discovery. I found out that education is as essential to the persistence and progress of

human society as is the light of the sun and the water brought by the rain for the growth of new crops. I discovered the thoughts of those numerous people preoccupied with improving the ways we pass on our knowledge, skills and attitudes to the younger generations. I empathised, while looking back in time, with the millions of doctors who learned their profession in just the same way I did, by striving day after day to understand and to care for their patients.

I reflected on the intricacies of planning a course in any area of education. I came to appreciate the remarkable power of the curriculum to empower the learners, as well as the enormous negative influence it may have, by omission or by commission, on the professional and moral formation of new generations. I came to understand the responsibility that someone assumes when they undertake to plan a course and to appreciate the need to apply proper procedures to ensure the quality of the planned training. I also understood that, apart from following the tradition and the standards set by the society, it is extremely important to give the learners, as well as the graduates from the course, a voice in the debate on the planned contents and teaching methods.

I further discovered that there are ways of discerning a coherent message from what seems like chaos, when surveying the opinions of people. I learned how to work with such methods and discovered the joy of getting results. Through reflection on all that I did during the course of this investigation, I became a better teacher and a more confident researcher.

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ADDENDUM A

Dear Colleague / Student

ASKING FOR YOUR VIEWS ON THE CONTENT OF THE HAEMATOLOGY TRAINING FOR UNDERGRADUATES AT STELLENBOSCH MEDICAL SCHOOL

My name is Cristina Stefan and I am a lecturer in Paediatrics at Stellenbosch University. I am currently responsible for the Haematology training of the undergraduate students. In this capacity, I am preoccupied to ensure that what the students learn is going to be useful in treating their patients and, at the same time, will form a sound basis on which to add new professional knowledge and skills.

I am inviting you to participate in a study that I planned and which will be the basis of my doctoral thesis in higher education. The aim is to survey your opinions on what elements of knowledge and skills in haematology are required in your present practice and should therefore be taught in medical school.

If you are a student, besides your opinion on the practical usefulness of various subjects and skills taught in haematology, I would like to find out to what extent the knowledge you acquired has helped you to understand the functioning of the human body as well as the processes that generate other diseases in humans.

You are under no obligation to participate in this study. Your consent to participate is requested by means of the attached reply slip: please tick the box marked “yes”, write your name and the date of completion, sign and post it to Dr C Stefan Department of Paediatrics & Child Health Tygerberg Hospital/Stellenbosch University PO Box 19063 Tygerberg 7505 or e-mail a scanned copy to cs@sun.ac.za. If you decide to participate, please indicate the preferred means of corresponding - letter or e-mail - on the slip.

What is expected of you if you participate in the study? You will receive, shortly after accepting to take part in the survey, a first questionnaire. If you are a doctor, the questionnaire will ask you to critically scrutinize your daily practice and name those elements of knowledge and skills in haematology that you need in your activity. You will also be asked to recall your undergraduate training in the faculty and identify those elements that were not taught but which presently are

often required for successful practice. The questions will be open but your answers need to be as specific as possible.

If you are a student, the questions will investigate the areas outlined above: practical usefulness of the knowledge taught and its role in helping you to understand other fields of medicine.

Your answers will be analyzed and – on the basis of your suggestions - a list of diseases and skills will be drawn; this will be as comprehensive as possible and may contain some elements that you did not mention. You will be asked to rate these in order of importance for your activity.

Another round of letters may be necessary, in order to harmonize the divergent opinions of the participants. I will show you the results of the previous survey and will ask you if, after seeing all other peoples' opinions, you may want to reconsider your answer. This method, called the Delphi method, is often used in order to elicit experts' opinions on various issues.

The final results will be used in order to draw up a list of knowledge elements (a curriculum) for the training of the medical students in haematology. This will be compared with the present curriculum, which was drawn up by a panel of specialist doctors, and the significance of the differences will be analyzed. Finally, proposals will be made for a new curriculum in haematology. I will also evaluate how useful the Delphi method is for gathering information on faculty curricula. I will inform you of the final result of the survey.

I wish to thank you for the time spent reading my letter and hope that I succeeded in interesting you to take part in this study. Should you require more information, please e-mail me at cs@sun.ac.za, or phone 021 9389404/021 9389584.

Dr DC Stefan

ADDENDUM B

QUESTIONNAIRE (DOCTORS)

Do you consent to participate in the study as outlined in the introductory letter?

YES
NO

Please type your name .....

Signature.....

Date.....

Please answer as comprehensively as possible, using an additional sheet of paper if necessary:

- Have you required any haematological knowledge or skills in your practice in the last year? If so, please list all of them.

- What haematological problems have impacted on the health of your patients in the last year?

- What comments do you have about your own undergraduate haematology training? Was there anything which was not taught but which would have been helpful in your present activity?

- Which elements of the theory or skills are 'marginal' for inclusion/exclusion in an undergraduate training programme (i.e. possible 'grey areas')?

ADDENDUM C

QUESTIONNAIRE (STUDENTS)

Do you consent to participate in the study as outlined in the introductory letter?

YES
NO

Please type your name.....

Signature.....

Date.....

Please answer as comprehensively as possible, using an additional sheet of paper if necessary:

Have you required already any haematological knowledge and skills in your interaction with patients? If so, please list them below.

What subjects and skills taught in haematology would be useful for your future practice and which ones do you consider less useful? Please list them below.

List elements of haematology which are helping you in understanding the normal and pathological processes in humans. List separately those elements that you think should be taught but are not yet in the curriculum.

Which elements of the theory or skills are 'marginal' for inclusion/exclusion in an undergraduate training programme (i.e. possible 'grey areas')?

ADDENDUM D

QUESTIONNAIRE (HAEMATOLOGISTS)

Do you consent to participate in the study as outlined in the introductory letter?

YES
NO

Please type your name .....

Signature.....

Date.....

Please answer as comprehensively as possible, using an additional sheet of paper if necessary:

Please list those elements of knowledge and skills which, in your opinion, should be taught in the undergraduate haematology program.

Please list any elements of haematological theory or skills that you would not include in an undergraduate training program.

Which elements of the theory or skills are 'marginal' for inclusion/exclusion in an undergraduate training programme (i.e. possible 'grey areas')?

ADDENDUM E

Dear colleague,

I would like to thank you for taking part in this Delphi process.

Aim of the first round

Based on your answers and the topics included in the curriculum the following list was established. It includes 43 questions relevant to the curriculum in haematology.

You are asked to rate the importance of the these subjects according to the scale from 1 to 4 where 1 relates to a subject which is not at all important so you strongly disagree that it should be included in the curriculum, 2 a subject which is not important (you disagree), 3 the subject is important but not essential (you agree) and 4 the subject is essential, maximum importance and definitely should be included in the curriculum.

Please answer all questions. We are aiming to get consensus on all topics.

Your answers remain anonymous and confidential to all other participants and will be known only by the researcher.

The completion of this round should take you only 10-15 minutes at the most. Please fax back at 021 9389138 or email cs@sun.ac.za

I would like to thank you once again for your willingness to be of assistance in this research.

Regards,

Cristina Stefan

ADDENDUM F

TOPICS PROPOSED TO BE INCLUDED IN THE CURRICULUM

Rate the answers on a scale of 1- 4

1 - strongly disagree (subject not at all important)

2 - disagree (subject not important)

3 - agree (subject important but not essential)

4 - strongly agree (maximum importance)

Please mark your new score with an x. For example:

		1	2	3	4	Your choice
1.	**Macrocytic anaemia**					
	Opinion of participants					

		1	2	3	4	Your choice
1.	**Macrocytic anaemia**					
	Opinion of participants					
4.	**Normocytic anaemia**					
	Opinion of participants					
5.	**Neonatal anaemia**					
	Opinion of participants					
6.	**Anaemia in childhood**					
	Opinion of participants					
7.	**Iron deficiency anaemia**					

	Opinion of participants				
8.	**Haemolytic anaemia**				
	Opinion of participants				
9.	**Spherocytosis**				
	Opinion of participants				
10.	**Sickle cell anaemia**				
	Opinion of participants				
11.	**Thalassaemia**				
	Opinion of participants				
12.	**Autoimmune haemolytic anaemia**				
	Opinion of participants				
13.	**Folate and vitamin B12 deficiency**				
	Opinion of participants				
14.	**Hereditary platelet defect**				
	Opinion of participants				
15.	**Acquired platelet defect**				
	Opinion of participants				
16.	**Bleeding child**				
	Opinion of participants				
17.	**Clotting tests interpretation**				
	Opinion of participants				
20.	**Thrombocytopenia**				
	Opinion of participants				

21.	**Thrombocytosis**				
	Opinion of participants				
22.	**Pancytopenia**				
	Opinion of participants				
23.	**Haematological changes of HIV/AIDS**				
	Opinion of participants				
24.	**Aplastic anaemia**				
	Opinion of participants				
25.	**Fanconi anaemia**				
	Opinion of participants				
26.	**Haemophilia**				
	Opinion of participants				
27.	**Secondary polycythaemia**				
	Opinion of participants				
28.	**Myelofibrosis**				
	Opinion of participants				
29.	**Neutropenia**				
	Opinion of participants				
30.	**Lymphopenia**				
	Opinion of participants				
31.	**Leukemia**				
	Opinion of participants				
32.	**Lymphoma**				

	Opinion of participants				
33.	**Myeloma**				
	Opinion of participants				
34.	**Monoclonal gammopathy**				
	Opinion of participants				
35.	**Cytostatics**				
	Opinion of participants				
36.	**Blood components**				
	Opinion of participants				
37.	**Blood groups**				
	Opinion of participants				
38.	**Rh**				
	Opinion of participants				
39.	**Blood transfusion**				
	Opinion of participants				
40.	**Thrombosis**				
	Opinion of participants				
41.	**Anticoagulant therapy**				
	Opinion of participants				
42.	**Hypercoagulopathy**				
	Opinion of participants				
43.	**Anaemia in pregnancy**				
	Opinion of participants				

ADDENDUM G

Delphi questionnaire, Round 2

27 April 2008

Dear colleague,

I would like to thank you for taking part in this Delphi process and for completing the first round.

Aim of the second round

The questionnaire for round 2 consists only of questions or statements where consensus/agreement was not reached in round one.

Consensus is defined according to the literature of Larson and Wissman (2000:45) where 80% of all participants vote on a specific item within the same value of the four-point scale.

The questions where consensus was reached are not included in the second questionnaire. The second round is shorter than the first round.

The questions where consensus was not reached will be repeated in the same way as in the first questionnaire. You will also see the responses of the other participants. This is recorded as a percentage of participants that has indicated a specific value. Your own response appears at the end

Example

Macrocytic anaemia score 1 2 3 4 your score = 3

Participants 0 10% 40% 50%

Interpretation: 50% of participants considered macrocytic anaemia extremely important (score 4)

40% considered macrocytic anaemia important (score 3 - you are one of them)

10% of participants thought macrocytic anaemia was not important.

Your choice was 3. This round enables you to reconsider your opinion on a specific statement, in light of the opinions of other participants.

During this round you are allowed to change your opinion if you want. You have also the possibility to add any new comments.

Please answer all questions. We are aiming to get consensus on all topics.

Your answers remain anonymous and confidential to all other participants and will be known only by the researcher.

The completion of the second round should take you only 5 minutes at the most. Please fax back to 021 9389138 or email cs@sun.ac.za

I would like to thank you once again for your willingness to be of assistance in this research.

Regards,

Cristina Stefan

ADDENDUM H

Delphi questionnaire

Round 3 (LAST ONE)

10 June 2008

Dear colleague,

I would like to thank you for taking part in this Delphi process and for completing the first two rounds.

Aim of the third round (last round!)

The questionnaire for round 3 consists only of questions or statements where consensus/agreement was not reached in round one.

Consensus is defined according to the literature where 80% of all participants vote on a specific item within the same value of the four-point scale.

The questions where consensus was reached are not included in this last questionnaire. The third round is shorter than the previous ones.

The questions where consensus was not reached will be repeated in the same way as in the first 2 questionnaires. You will also see the responses of the other participants. This is recorded as a percentage of participants that has indicated a specific value. Your own response appears at the end

Example

Macrocytic anaemia score 1 2 3 4 your score = 3

Participants	0	10%	40%	50%

Interpretation: 50% of participants considered macrocytic anaemia extremely important (score 4)

40% considered macrocytic anaemia important (score 3 - you are one of them)

10% of participants thought macrocytic anaemia was not important.

Your choice was 3. This round enables you to reconsider your opinion on a specific statement, in light of the opinions of other participants.

During this round you are allowed to change your opinion if you want. You have also the possibility to add any new comments.

Please answer all questions. We are aiming to get consensus on all topics.

Your answers remain anonymous and confidential to all other participants and will be known only by the researcher.

The completion of the third round should take you only 5 minutes at the most. Please fax back to 021 9389138 or email cs@sun.ac.za

I would like to thank you once again for your willingness to be of assistance in this research.

Regards,

Cristina Stefan