# Finding a Method to Analyze Qualitative Data: Using a Study of Conceptual Learning

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*Abstract:* There is increasing awareness in the health sciences of the potential of qualitative research to address questions that quantitative research cannot satisfactorily answer. While a growing number of studies in health sciences and health sciences education discuss the value of such research or describe the methodology and data collection processes, few detail how analysis was carried out. Reliability and validity of findings from qualitative research depend on the quality of data management, retrieval, and interpretation or identification of meaning. The robustness of data analysis is therefore an important factor in the rigor of qualitative research. This article uses a study of dental students' conceptual learning to illustrate strategies that ensure rigor in qualitative analysis. Factors that informed the decisions regarding analysis are discussed in detail. The use of both grounded theory and literature is discussed. The role that deductive and inductive reasoning played in the analysis is outlined. A brief section illustrates the kinds of conclusions that can be made about conceptual learning when qualitative data are rigorously analyzed. Finally, potential shortcomings in the study and alternatives or additional mechanisms for ensuring validity and reliability of analysis are discussed.

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There is growing awareness in the health sciences of the potential of qualitative research to address questions that quantitative research cannot satisfactorily answer. Studies and commentary from nursing,[1,2] palliative care,[3] medicine,[4-10] and dentistry[11-14] are emerging, as is qualitative research in medical education[15-19] and, more recently, dental education.[20] Qualitative research shifts the focus from providing information about the numerical "what" to understanding other aspects of what, how, and why.[13,21] It offers an "understanding of complex phenomena in their natural environment, often from the standpoint of those experiencing these phenomena" (p. 2171),[21] and is thus well suited to examining perceptions and behavior, organizations, and culture.[9] It is these characteristics that make qualitative methods eminently suitable for understanding the human aspects of clinical and health sciences education contexts.

There is as yet only a small body of literature in dentistry and dental education with a focus on qualitative methods. The emphasis in this literature is on the value of the qualitative approach,[12,13,20] suitable data collection methods,[12,13,20] and application of qualitative methods in specific dental[14] and dental education contexts.[22] However, there is little literature with a dental and dental education focus that engages with approaches to analysis—a notable exception being Burnard et al.,[11] an article that provides a "pragmatic" (p. 429) approach to analyzing qualitative data. The current article sets out to make a contribution in this regard, using data from a study that examined student learning to explicate the "processes and pitfalls" (p. 433)[3] of qualitative data analysis. Shenton[23] highlights the importance of a rigorous analysis process: it allows those scrutinizing a particular project to make proper assessment of the robustness of the analytical procedures that were followed, and if there is sufficient detail about how the work in the analysis proceeded, it allows future researchers to repeat the study with different informants, in another geographical location, or with a different organization and to posit sound comparisons.[12,23] Finally, Shenton[23] suggests that novice researchers may look to design their own analysis with the help of insights from accounts of previous studies in related areas.

This article commences with a brief background to the study. The study is then located in the literature regarding conceptual learning. Thereafter, the methodology of the study is outlined, and the process of analysis is described in detail. Discussion highlights

the rigor and depth required for valid qualitative data analysis. Potential shortcomings in the analysis of the current study and alternative or additional mechanisms for ensuring validity and reliability of the data analysis are discussed in the conclusion.

# Background of the Study

A common complaint in the education of health professionals is that students struggle to apply in the clinical context what they have learnt theoretically.[24-27] A synthesis of the literature regarding clinical reasoning[28-32] and that related to conceptual understanding[33-35] indicates that clinicians can only synthesize and apply what they have learnt conceptually.[36-40] Conceptually learned knowledge is made available for clinical application through processes that structure incoming information in the light of existing memory structures and simultaneously extrapolate from this to generate plausible interpretations of the information.[29-32,39,41-44]

A concept is an encapsulation of ideas that are attributable to a single class or grouping—what Carey[45] defines as "units of mental representation" (p. 89). Conceptual understanding implies knowledge of an idea and how it relates to already acquired ideas.[46] It requires an understanding of the contexts within which the idea is applicable, as well as its limitations.[46] Conceptual learning, according to MacLellan,[33] is the acquisition and application of new knowledge to result in symbolic representations not previously in the learner's network of knowledge. It involves learning the meaning of a new idea or making connections between two previously unrelated ideas.[33] A dental example of a concept might be that of "bio-compatibility." "Zip-filed" within the concept of bio-compatibility must be all that the student knows about the biological context and the physical and chemical properties of various materials. These must be plaited into an explanation that is so coherent to the student that it can be used as a "filter" for deciding on a treatment plan without the need to consider each biological, physical, and chemical aspect separately.

The literature suggests that there are four key characteristics of conceptual learning: the ability to

- extract what is "central, essential, or generic" (p. 133) from a context and create a mental representation of these attributes,[33]
- "chunk"[47,48] these "units of representation" (p. 89),[45]
- generalize from what has been learnt in the past to new learning,[49] and
- transfer these generalizations from one context to a different context.[49]

The longitudinal study upon which this article draws set out to explore if a relationship was evident among preclinical academic success, conceptual learning, and later success in clinical reasoning. The first phase of the project set out to examine the learning strategies of academically successful preclinical students—specifically whether they learnt conceptually. This aspect is reported on here.

# Methods

A qualitative methodology was used for the study. Qualitative studies have two applications. First, qualitative methods are increasingly viewed as a means of generating hypotheses and identifying problems for subsequent quantitative study.[1,9,10,12] Secondly, qualitative studies help generate answers to research questions that investigate the what, why, and how of people's lived experiences[10,12,13]—in other words, those questions that quantitative studies cannot answer. Mason[50] argues that qualitative research allows in-depth insight into how examples of a category behave.

In the study reported here, the "examples" were the ten students (of a class of 100) who had obtained more than 65 percent in a third-year dentistry course, Dental Materials. Studying the learning strategies of this sample of the category "academically successful students" would allow some claims to be made about how effective preclinical students learn.[51] Seven of these students consented to be part of the study, and each signed consent after the study design had been approved by the Ethics Committee of the university. It was decided not to extend the database by interviewing other students as that would have violated the inclusion criterion of 65 percent or more. Dental Materials was selected as an appropriate focus because it bridges preclinical knowledge and clinical application. It draws on prior knowledge from physics, chemistry, anatomy, and physiology and has a significant relationship with diagnosis and treatment planning.

## Data Collection

Triangulation—the collection of data through more than one method[51]—was a key principle in the collection of data for the study. Studying human

behavior from more than one standpoint provides a richer, fuller account and is a powerful way of ensuring concurrent validity.[51,52] Initial data were collected from a single combined interview and observation session that took about two hours per student. The session commenced with a semistructured, one-on-one interview that provided extended self-report on the student's personal background, his or her perceptions and experiences of studying, and the methods that he or she adopts, as well as his or her attitude towards and assumptions about the relevance of learning about dental materials (see Appendix).

This interview was audiotaped and later transcribed so as to provide the word-for-word text needed for the analysis process.[23] Such detailed transcripts are essential both for an accurate account of what students said and for providing a source of the lengthy quotations that are usually incorporated into qualitative research reports as part of the interpretation validation process.[23] In this way, verbatim transcripts strengthen the "audit trail" (p. 21) of a study.[53]

The self-report interview was followed with observation of learning in a quasi-realistic context in order to record what learners actually do rather than what they recall or believe they do. Each student spent about forty-five minutes learning a section of Dental Materials content that he or she had selected. The learning was authentic as it needed to be done for the frequent assessments in the subject. However, the context (the Academic Support Office) was not the student's normal learning environment. The observation was recorded in the form of running records.[54] Running records are a written description by the researcher of what is being observed.[54] In this study, running records entailed detailed description of exactly what the student was doing as he or she studied the section of work. Immediately after each interview and observation, the running notes were annotated with details regarding events and actions that the researcher had not had time to record during the observation.

The contact session concluded with a further interview with the student regarding what had been observed. This was an opportunity to ask in-depth questions about observed student actions,[55] as well as to elicit, where necessary, information about aspects of the student's learning practice that were not readily observable but might have been surmised from the observations.[54] This interview was also audiotaped and later transcribed.

## Data Analysis

While there is no single correct method for analyzing data, the approach must reflect the purpose of the study.[3,56] The purpose of this study was to examine whether students who are academically successful in preclinical subjects learn conceptually. Two approaches were possible. In the first approach, the researcher might use the categories/characteristics from the literature as a checklist when observing and interviewing the students.[10,57-59] Such an approach has the advantage of capturing incidents that match the criteria extrapolated from the literature. However, it had some disadvantages. First, the characteristics/categories were not very clearly spelt out in the literature. In the case of this study, most of the concepts, including chunking, were not clearly defined in the literature, and this posed problems for the researcher regarding exactly what to look for in order to recognize when chunking, for example, was happening. The danger here is that, in the initial data collection, the concept is either too narrowly defined so that significant evidence gets ignored or too broad so that irrelevant data are collected into an inappropriate category, resulting in inaccurate conclusions being drawn from the data as evidence. Secondly, the researcher may impose prior expectations on the data and force data into preconceived categories.[60] This strategy may result in the researcher "finding" what he or she is looking for even if it isn't there. It may also result in significant patterns, trends, and behaviors not being recognized because they are not initially assumed or recognized as significant to the phenomenon being observed or discussed. As Sharma et al.[61] note in a study of students' learning, "If we use predetermined categories, we may fail to identify important conceptions and ways of thinking."

The second approach to analyzing data is to facilitate the process whereby authentic evidence relevant to the study emerges from the data.[62] In its pure form, this approach (called "grounded theory") relies on systematic categorization of the data, and theorizing is limited until patterns in the data emerge through the categorization process.[63] This process is inductive: concepts are "discovered" in a data set.[62] The primary purpose of grounded theory, therefore, is to generate explanations of human behavior that are grounded in the data.[63] This approach also "forces the researcher to safeguard against 'pet' themes and ideas, unless they have an emergent fit" (p. 608)[1]—that is, against finding what the researcher expects or wants to find.

However, this approach is not without its shortcomings. It is debatable whether any researcher comes to a research question, its context, and data without any preconceptions—whether from the literature or from empirical experience.[64-66] Neither approach, therefore, was ideal for understanding a research context in which theoretical literature existed, but where a paucity of empirical studies meant that no prior methodology was signaled as the best way of interpreting students' conceptual learning. Therefore, in seeking an approach to the analysis of the data for the conceptual learning study, a synthesis of induction and deduction was sought. Bulmer[59] highlights the iterative process: "Concept-formation in the analysis of sociological data proceeds neither from observation to category, nor from category to observation, but in both directions at once and in interaction" (p. 653). In analysis, the researcher sought a strategy that acknowledged existing literature while simultaneously remaining open to possible new findings—what Strauss[67] refers to as a mix of analytic and emergent categories.

Literature on inductive analysis emphasizes that detailed data, as closely approximating the social reality as possible, is necessary if understanding is to emerge from, rather than be imposed on, the evidence.[2] Thus, the anticipated analysis approach influenced the way in which the data was recorded as text: running record observations[54] were as detailed as possible and attempted to record and describe all observable behavior,[68] and interviews were recorded and transcribed verbatim. Field notes, written directly after each session, recorded initial impressions[23] and frequently served to identify initial analytical categories,[69] as did the annotations on the observation records.[69]

Preliminary theme tracking (p. 147)[23] was the first step in the analysis process. This involves attention to any preliminary themes identified in the field notes, as well as a careful reading of transcripts and observation records in order to detect recurring patterns. Shenton[23] suggests that where data within the transcripts remind the researcher of literature or other empirical experience or research in the study field, a note should be made to this effect. In this way, early identification of themes is prompted both by prior experience in and literature of the study field, as well as through recognizing those themes that emerge authentically from the data.

Thereafter, each transcript, field note, and observation record was read line-by-line[1,2,52] in order to identify inherent topics or themes for each.[23,69,70] Each topic or theme was indicated by a code.[23,52] Codes serve to summarize, synthesize, and sort—"to pull together and categorize a series of otherwise discrete events, statements, and observations" (p. 112).[71] A record of the relevant code may be made in the margin[2] or through the use of colored pens or markers in the text.[3,23] In the student learning research, the relevant piece of text was highlighted with a colored marker (underlined in the text below), and the appropriate code recorded in the left hand margin. How potential themes regarding learning, strategies for learning, and factors that might influence effective learning were identified, named, and recorded is illustrated below:

**Role model** "Loads more work. When my father told me that school is a picnic compared to university, I thought he was joking because I thought matric was the most work I would ever do. But it is just the
**Workload** workload. The workload is a lot more. You have to be a lot quicker and a lot more; you have to pick
**Recognize core** out the important stuff. You can't go through everything and expect to—Ja, I just go through the most important—the things that I think will be the most important."

Glaser and Strauss[62] suggest that the researcher use constant comparison to validate whether common themes are emerging across the data. Shenton[23] explains that the process "initially involves the comparison of each unit of meaning within a transcript with previous units so that it may be categorized and coded with like units. If there are no such similar units, a new category is formed" (p. 147). In the student learning research, a grid system was used to achieve this comparison. Codes for the names of the students were entered in the first column. As a potential theme was identified, it was recorded in the top row. The page number from the interview transcript or observation record and, where necessary, a phrase for clarification were recorded under the heading in the row allocated to that student. Table 1 illustrates this process for the first transcript and observation record.

The process of identifying themes was followed for the interview transcript and observation record of each student in the cohort. As this process proceeded, more themes emerged. This meant going back to the interview transcripts and observation records from students that had already been coded to see if there

**Table 1. Organizing the data**

| Code | Prep for lecture | Self-discipline; motivation Sense of self Challenge | Time Workload Not difficult | Learning interesting Learning needs to be done | Understand | Basic science | Link to clinical | Daily review Consistent work | Core |
|---|---|---|---|---|---|---|---|---|---|
| C | None (3,4) | Self-discip (4) Motivation (5) Self-competitive (10) | Time (4) Load (6) Not difficult (6) | 5, 15 | In-depth (9, 17) | Refer back (16) | 10, 18 | No evidence | 6, 7, 14, 16 |

was evidence fitting into the emerging themes that had previously not been recognized as significant. Similarly, some themes disappeared when they were evident for only one or two students. There were thirty themes in the final analysis.

There are a number of mechanisms that researchers can use to ensure that their interpretation is a valid and reliable account of both the research subjects' experience and behavior and the meaning of that experience and behavior. Each research participant might be asked to examine the analysis of his or her experience and behavior and to consider whether it is a valid and reliable account.[10,23,52] This strategy serves as a triangulation mechanism to corroborate findings[72,73] and helps the researcher to test whether his or her analysis rings true (p. 409).[19] For each student, the evidence from the interview transcripts and the observations was recorded in full alongside each of the themes. Each student was asked to comment on the researcher's interpretation. While there was much discussion, none of the students disagreed with the thematic interpretation of their testimony or the evidence from the observation.

Returning the data and its analysis to the participants for scrutiny and comment is one mechanism for ensuring validity and reliability. A further mechanism is to ask another researcher who has not been involved in the data analysis process to give an opinion on the accuracy of the match between themes and data.[23] Any data that are agreed by both to "lie uneasily within a category" (p. 152)[23] should be moved into a more appropriate theme or the creation of a new theme may be necessary. It is then recommended that the original researcher return to the raw data in order to ensure that no inherent themes have been omitted. Alternatively, initial categorization can be done independently by several researchers who analyze that data independently.[12,61] After this initial categorization, the researchers meet to discuss their categories, interpretations, and the criteria they used to map data and themes. Through discussion and re-examination of the original data and larger samples, consensus is sought regarding the final set of categories.[61] This strategy was not adopted in the student learning study; potential shortcomings with regard to validity and reliability that may have resulted from this omission will be discussed later.

In the student learning research, once the themes that had emerged from the data had been identified, the literature was used to organize these themes into categories or concepts.[10,71] The four key characteristics of conceptual learning identified in the literature[33,45,47-49] (and signaled earlier in this article) were used to distinguish which of the thirty themes were associated with conceptual learning. To do this, the definitive essence of each of the characteristics was distilled,[23] and explicit rules for inclusion of data within each category were constructed. This process of generating explicit rules for inclusion in a category helps define the relationship between different themes as aspects of a single concept. To aid this process, Miles and Huberman[58] suggest the use of concept webs. Related themes are clustered, and relationships between themes within a concept, as well as the relationship between concepts, are indicated. This process ensures that only data that authentically belong within a category can be included, and is one mechanism for resisting the bias that leads a researcher to find what he or she wants to see. The setting of these explicit inclusion rules is thus a mechanism for ensuring validity and reliability in qualitative analysis.[10,23,52]

In this study, the features of the four key characteristics of conceptual learning were used to

generate the rules for inclusion. Thus, for example, the inclusion features for the category of extracting what is "central, essential, or generic" (p. 133) from a context and creating a mental representation of these attributes[33] included evidence that the student understood that there were key (or core) aspects to the content they were learning, actively sought to identify what these were, identified these aspects as what needed to be mastered for competence in the subject, and demonstrated that he or she captured these key aspects in capsules of knowledge whether through a descriptive term or reference to a visual representation. Only when the inclusion criteria for all four categories were described was the data categorized, first under thematic titles and then incorporated under each of the four key categories.

Eight of the initial themes were identified as relevant to conceptual learning: "classroom behavior," "attendance," "daily review," "consistent work," "basic sciences," "link to clinical," and "core." Thereafter, each theme was subsumed under a thematic title that helped signal the relationship of the theme to conceptual learning; for example, "basic science" became "concerted linkages with prior knowledge," and "daily review" and "consistent work" became "reviewing what has been learnt." Table 2 illustrates the coded data for seven students for the six final themes related to conceptual learning.

# Results

The discussion that follows indicates the relationship among the four key characteristics of conceptual learning identified from the literature and the themes generated by analyzing the data.

## Extract what is central, essential, or generic, and generate mental representation.

The inclusion feature rules for the category of extracting what is "central, essential, or generic" (p. 133) from a context and creating a mental repre-

**Table 2. Coded data**

| Code | Going for understanding | Recognizing what is core | Making meaning in contact sessions | Concerted linkages with prior knowledge | Concerted linkages to clinical application | Reviewing what has been learnt |
|---|---|---|---|---|---|---|
| C | In-depth (9, 17) | 6, 7, 14, 16 | 9 | Refer back (16) | 10, 18 | No evidence |
| Lm | 15, 17, 18, 20, 21 grid | 5, 13, 20, 26, 27 | 6, 7, 8, 17, 23 | 17, 18 grid | 14?, 15, 17, 18, 23, 24 grid | 5, 9, 12, 18 Learn as much as possible (13, 14) |
| S | 3, 5, 7, 9, 10, 15 understand background (17) 20 | 5, 7, 17 | 10, 11, 12 | No evidence | 7, 13, 22 | 5, Study timetable (16) |
| D | 11, 19 | 8, 16 concept (15) more than core (17) 24, 25, 26 | 8, 10, 11, 12 | 20 | 6, 13, 15 23 25 27 | 8, 9 11, 14 17, 19 24 |
| LF | 5, 8, 9 13, 15, 19 Makes sense (17) | grid | 5, 10, 11, 12, 14, Dr. S says (17) | No evidence | 6, 9, 13 | 4, 5, 11, 12 |
| O | 2, 10, 14 18, 29, 32 | 25, 26, 28, 29 | 1, 13, 28 | 2, 10 | 10 | 16, 17, 30 |
| A | 8, 10, 11, 16, 19 20 | 11, 19 | 3 4 14, 15 | 7, 8, 16 | 4, 10, 17 21, 22 | Starting early (7) 7 13 18 |

sentation of these attributes[33] included evidence that the student understood that there were key (or core) aspects to the content that they were learning, actively sought to identify what these were, identified these aspects as what needed to be mastered for competence in the subject, and demonstrated that he or she captured these key aspects in capsules of knowledge whether through a descriptive term or reference to a visual representation.

Characteristic of all seven academically successful students was their determination to get at the essence of what they were being taught—to recognize what was central, essential, or generic.[33] Evidence for this drive was located in the theme "recognizing what is core" and was exemplified in statements like "We need to have a core knowledge. I find out what this is" and "You have to pick out the important stuff." The generation of mental representation was evident in references to concepts and principles—for example, "I put all the concepts together" and "You should know general basic principles for each dental material."

## Chunk these units of representation.

The inclusion feature rules for the category of chunking[47,48] the "units of representation"[45] (p. 89) included recognition that facts needed to be clustered so as to make sense of new learning, an emphasis on understanding (since, first, facts can't be clustered without an understanding of the topic and the way in which the various bits fit together; and, secondly, understanding is an essential part of generating personal new learning since real/deep learning is not possible without understanding[74,75]), and drawing on prior knowledge to link with and understand new information.

Evidence from the theme "going for understanding" highlights how these students drew on the concepts and principles they had already constructed in order to understand—for example, "For me, it's more understanding. I put all the concepts together and it is better for me to understand it like that." This suggests that they used understanding as a tool for chunking information for easy retrieval.[47,48] For example, "I will have an understanding of this and I will use this as my basic information."

## Generalize from past to new learning.

The inclusion feature rules for the category of generalize from what has been learnt in the past to new learning[49] included a recognition that new information linked with previous learning and that it was necessary to search for the linkages, that linked knowledge was easier to understand and to remember, and that prior knowledge would help them better understand what they were currently learning. Implicit criteria included an awareness that all aspects of what they were learning as dental students would be necessary for future diagnosis and treatment and that new and existing information needed to be linked in ways that assisted retrieval when necessary. Inclusion criteria highlighted being able to look backwards.

The theme "concerted linkages with prior knowledge" reflects the way in which these young people generalized from what they had learnt in the past to new learning.[48] The students explained how they drew on prior learning in basic sciences to understand new learning—for example, "I try to retrieve what I already know about it" and "It's the physics, it's the chemistry, and it is the understanding that I enjoy about materials."

## Transfer generalizations from one context to a different one.

The inclusion feature rules for the category of transfer generalizations from one context to a different learning context[49] included an awareness that all aspects of what they were learning as dental students would be necessary for future diagnosis and treatment and that new and existing information needed to be linked in ways that assisted retrieval when necessary. Also, there was evidence that students actively used/practiced/tried out in the clinical context what they had learnt theoretically (i.e., that which had been linked with prior knowledge and encapsulated). The South African dental qualification is a five-year undergraduate degree, so third-year students do not have much clinical experience or practice. Therefore, allusions to future application were also included in this category.

Evidence from "concerted linkages to clinical application" indicated how the students transferred their generalizations from one context to a different one.[49] For example, "If I don't understand something, usually I try in a clinical sense to see for myself" and

"You can't not understand dental materials and put a filling in a patient's mouth."

## Strategies to make it happen.

These academically successful students understood that the learning required to be an effective dentist entailed more than memorizing facts. They made use of a variety of learning strategies that facilitated this process. Evidence from the themes "making meaning in contact sessions" ("listening solely to the lecturer and then thinking of what questions you could ask for elaboration"; "actually sitting and listening and looking") and "reviewing what has been learnt" ("I go home and I'll sit with my books even if it is just making notes"; "What I take is the key bits from what the lecturers said and I base most of my studies on that") indicated that there were strategies utilized by all the academically successful students. Self-regulated learning theory[76,77] indicates that learning strategies like these promote the deep[74,75] learning necessary for conceptual mastery.

The preceding discussion, based on evidence from the empirical study interpreted through the lens of the literature regarding conceptual learning, has presented evidence that academically successful students practiced many of the behaviors associated with the development of conceptual understanding. They were aware that they should attempt to identify underlying concepts, or at least the key characteristics of what they were learning, a process that they described as helpful to them for comprehending, contextualizing, and organizing the subject matter.

# Conclusion

In discussing approaches to qualitative data collection and analysis, Froggatt[3] implies that the reliability and validity of findings from qualitative research depend on the quality of "both data handling, that is the management and retrieval of data, and interpretation, which concerns the identification of meaning" (p. 433). For Shenton[23] and Stewart et al.,[12] this means not only having valid and reliable methods of data recording, management, and analysis, but also reporting in ways that allow outsiders to scrutinize the rigor of the research process. In detailing the data collection and analysis process of this study of student learning, the researcher hopes to make a contribution to understanding the value of qualitative research methodologies in dental education and to have outlined an example of an approach that is valid and reliable within the qualitative paradigm.

Stewart et al.[12] outline five criteria for rigorous qualitative research. The research reported in this article meets four of the five criteria: purposive sampling to address bias concerns (only students who had achieved 65 percent or more in the designated subject were included in the cohort); grounded theory to show original theorizing in the work (grounded theory was used to categorize the data, and thereafter the literature was used to confirm the analytical categories); triangulation to confirm or refute internal validity (data were collected from interview self-report, from observation, and from interview confirmation of what had been observed); and respondent validation to confirm or refute interpretation of the data (categorization and interpretation of the data were discussed for confirmation with each student involved in the research). A weakness in the validity and reliability of this research is with regard to the fifth criterion: multiple coding to stimulate interrater reliability. In the research reported here, only one researcher coded the data since at the time of conceptualizing the study, it was felt that returning the findings to the subjects would serve as adequate triangulation of interpretation. However, further literature has indicated that this may not be the case[10,23,52] and that a variety of researchers categorizing the same data has the potential to provide a more valid and reliable categorization. Shenton,[23] however, notes that credibility can be added to research reporting if researchers are willing to "acknowledge honestly shortcomings and problems that were encountered" (p. 160). A recommendation is therefore that, in any future similar study, validity and reliability be ensured by both processes—eliciting informed and alternative opinion on the coding categories, as well as through sharing and confirming the analysis with the research participants.

Finally, researchers are cautioned with regard to the kinds of claims that they make about the significance of their qualitative study findings. Shenton[23] argues that since qualitative data are usually very specific to the context and the people who were investigated, the content of the theory generated from that data must be understood, to some extent, to be "particular to them" (p. 159). He warns that claims that such a theory is widely applicable should consequently be made with caution. It is therefore valid to argue that the findings discussed in this article explain the students' perceptions of the importance of focusing on concepts when studying. Given that this cohort

was representative of the kinds of dental students at the academic dental institution where the study was carried out, it is arguable that understandings from this study might be generalizable to other cohorts of dental students at this institution. It is arguable that findings from the study are useful because knowing how these students learn effectively has the potential to inform the kinds of support provided to less academically successful students and to the teachers who scaffold their learning. It might further be argued that findings from this study (and subsequent application of the findings) are transferable where contexts or students are similar to those in the study. Thus, it is possible to argue for a certain level of transferability of these qualitative findings.

A further significance of the study is the detail with which the methodology was described. This feature means that the study design might be repeated in a variety of contexts to find out whether students in similar and different contexts learn in similar or different ways.[12,23] Such findings will extend the body of knowledge that we have with regard to student learning.

A final significance relates to the relationship between the differing information that can be accessed through qualitative and quantitative studies. Qualitative research is perceived to be very effective to develop hypotheses in "newly emerged or underresearched areas" (p. 236),[12] which can then be tested using quantitative measures at a later stage.[10,12] Further quantitative studies might investigate other quantifiable aspects of student learning.

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# APPENDIX

## Interview Protocol

**Contributory factors**

Give me some background about yourself.

1. What is your home language?
2. Did your parents attend university? What did they study?
3. Where did you go to school?
4. What language were you taught in at school?
5. Did you come straight from school to study dentistry?

**Study methods**

1. Do you do anything special in preparation for a lecture? (i.e., does he or she access prior knowledge?)
2. What makes learning easy for you/difficult for you?
3. Generally, is learning easy for you?
4. Is university learning different from school learning? How, if so?
5. Does the way you are assessed influence how you learn? How?
6. Have you ever been taught how to learn? Where? What were the basic principles that they taught you?
7. Do you believe that there is any relationship between your marks and class attendance? Why?

**Assumptions about the dental materials course**

1. How do you feel towards the dental materials course?
2. Do you think that an understanding of dental materials is important for a dentist? Why?
3. Is dental materials easier or more difficult to learn than other subjects? Why?

**Learning of material**

1. Show me how you would learn the section of work that you have chosen.

**Observation**

(Take running notes.)

**Eliciting learning (after observation)**

1. How did you go about learning this section?
2. Was there anything in this section that you didn't understand? What are you going to do about that?
3. Why do you think you have to learn this section?
4. How will you use what you have learnt in the clinics?
5. Ask student questions probing mastery of content (from dental materials manual).
6. Thereafter (for each mastery question), ask:
    i. How do you know that this is the answer?
    ii. Where would you check your answers?
    iii. Give yourself a mark for your answer.