CHAPTER 3

REVIEW OF LITERATURE, AND ANALYSIS OF MUSIC TECHNOLOGY TRENDS

In this chapter, studies are reviewed on the use of technology in education, both outside the domain of music and within music. Current trends in Music Technology are traced. The purpose of the reviews of studies and both the international and national analysis of trends is to identify recurring conceptual issues and trends that inform qualification design in Music Technology as an emerging field of study in South Africa. With regard to the review of the literature, several studies have valuable contributions to make to the field of Technology. However, only a few of these studies impact directly on the current research. These are discussed in some detail here, based on their content and relevance to my work.

3.1 Studies outside of music

Technology in education has become an accepted practice worldwide, yet debate surrounding the use of such technology is ongoing and contentious, as is apparent in the studies discussed below. This debate also impacts on Music Technology because certain core competencies (components of Music Technology) overlap with other generic Technology areas: for example, Multimedia and Digitized Media, the Internet and Telecommunications, and Computers, Information Systems and Laboratory Management. Over the past decade, discussion forums and the number of publications pertaining to technology in education have been on the increase, for example the online *Journal of Technology Education* and the *Journal of the International Forum of Educational Technology and Society.*

3.1.1 Dixon: *Developing of a learning programme for the learning area Technology at Colleges of Education* (1998)

The adoption of a new education framework[12] in South Africa in 1995, at primary, secondary and post-secondary levels, has demanded a re-examination, on the part of educators, of curricula and learning programmes. In her PhD thesis *Developing of a learning programme for the learning area Technology at Colleges of Education*, Dixon (1998: iv) sets out "to develop a learning programme for Technology for the intermediate phase [school grades 4-

[12] National Qualifications Framework. Discussed in Chapter 4.1.2.

6] as part of the teacher education programme at colleges of education." Her study is based on the impact of outcomes-based education, the National Qualifications Framework, Curriculum 2005, the COTEP document (1996), the Technical Committee's discussion document on the revision of norms and standards for teacher education (1997) and the latter's final report on curriculum development at colleges of education.

Dixon examines different curriculum models, as well as the issue of the curriculum development process at post-secondary institutions with particular emphasis on the institution to which she is attached (Hoxani College of Education, Mpumalanga, South Africa). Dixon's empirical research centres on questionnaires and statistical data analysed to ascertain the correlation between the learning area Design and Technology[13] and other learning areas. The results of her study culminated in a learning programme for Technology for the intermediate phase, as part of the teacher education programme. This programme, accompanied by a questionnaire, was distributed to various education specialists in South Africa and abroad for their input. These inputs were analysed and the resultant recommendations were included in the final learning programme.

Some of Dixon's findings include: The need for colleges of education to develop and implement technology education programmes to satisfy future educator needs; the transformation process being delayed as a result of the unstable nature of the NQF, its supporting structures and the dichotomies and uncertainties that exist in implementing national policy documents (C2005, COTEP discussion and final documents); and expectancy of unqualified and untrained curriculum developers (educators) to develop learning programmes, contributing to low educator morale. These were all factors that affected the transformation process (Dixon 1998: 224-26). Although these findings are interesting, the scope of this study is somewhat limited. No qualification in the field of Design and Technology exists as yet. Therefore it is premature to design a learning programme, because the outcomes and assessment criteria cannot be measured against any qualification (see Chapter 5.2). For this reason the strategy adopted by Dixon will not be applied to my study. It is also not clear whether this is a programme for Design and Technology or Technology as part of the Organizing Field Manufacturing, Engineering and

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[13] Design and Technology is a learning area where the study of design is an integral part of technology education. Through the process of design learners bring together knowledge, skills and attitudes about technology. The application of knowledge through design enables learners to employ higher-level thinking skills as well as apply a range of technical skills.

Technology (see Table 4.2). Dixon's treatment of Technology as an area of study conforms to what Gibbons and co-authors refer to as Mode 1 (disciplinary) or the traditional form of knowledge production (Gibbons *et al* 1997: vii), where Technology is treated primarily as the making of artefacts.

The present study nevertheless benefits from Dixon's research in that hers is one of the first studies that attempt to implement the requirements of current South African education policy.

3.1.2 Dooley, Metcalf & Martinez: *A study of the adoption of computer technology by teachers* (1999)

Computers are widely used in many areas of education and their use within Technology-based curricula is therefore noteworthy. Dooley *et al* (1999) undertook

> to determine the role of professional development and training in the adoption of computer technology and telecommunications in a training case study. Research questions included:
>
> 1. What were the percentage of concerns that were self, task, and impact[14] concerns among high-, middle- and low-using computer technology and telecommunications users?
> 2. To what extent did the findings match or not match Rogers' diffusion of innovation research[15] (1983) and the Concern-based Adoption Model[16] (Hall *et al* 1973) for innovation and diffusion?
> 3. What were the factors that made an impact in the diffusion process and how might these training environments further enhance professional development and interventions for diffusion?

Their study used naturalistic inquiry[17] in combination with a variety of qualitative and comparative methods (for data analysis) as its methodologies. These methodologies allow

[14] Self refers to the individual's concerns, task refers to operational concerns, and impact refers to concerns dealing with future decision making.

[15] The process through which an individual passes from first knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea and to confirmation of this decision (Rogers 1983: 20).

[16] A model that views change as a process rather than an event and examines the various motivations, perceptions, attitudes and feelings experienced by individuals in relation to change (Hall *et al* 1973).

the researchers to develop working hypotheses and grounded theories (Roger's Diffusion of Innovations and Hall *et al's* Concern-Based Adoption Model) within the context of the schools. The process was based on the confidential interviewing of various stakeholders in education in a targeted district in Texas, USA. The results of this study reflect the following responses to the three research questions (Dooley *et al* 1999):

- The percentage of concerns were: self = 23%, task = 38%, impact = 39%, with regard to how teachers felt on the continuum of users of computers and telecommunications, high = 23%, middle = 46%, low = 31% (in terms of teacher profiles). The respondents with high concerns felt that computers would not replace their positions.
- The findings closely matched Rogers' diffusion and innovation research and the Concern-based Adoption Model. Higher users of technology had a favourable attitude toward change and responded positively. Middle users were more deliberate, sceptical and cautious, with low users reflecting little interest, suspicion and resistance.
- Several factors (personnel concerns, administration factors, to name a few) can be attributed to the overall diffusion ("the process by which innovation is communicated through channels over time among the members of a social system" [Rogers 1983: 10]) of computer technology and telecommunications. These concerns of personnel, and administrative factors contribute to the change process.

The findings highlight the notion that teacher training and college courses are not quick-fix solutions to address technology training expertise. Attention also needs to be given to teachers training teachers. A weakness that could easily be overlooked with regard to Dooley *et al's* study is the exceptional circumstances relating to it. This case study uses an informal training set-up, which could be manipulated by the researchers (Dooley *et al*) to yield the desired results. Also, the particular school where the study was undertaken had many resources. The strength of this study, though, suggests that it is possible to translate diffusion and change studies into a variety of different contexts and apply them to a vast array of innovations.

[17] A research approach located between the quantitative and qualitative, in which one attempts to study something in its natural habitat.

3.1.3 Barnard: *Computers in FE (Further Education) biology – a study of how teachers' classroom practice can be affected by different types of software* (1999)

Also related to computers, Barnard's (1999) research "aimed to examine how the use of educational technology could affect teachers' classroom practice and vice versa". Her research focuses on nine classroom observations of teacher-student interaction with computers in the USA. Using Brown and McIntyre's (1993: 63) framework, which examines how teachers organized their thoughts about their usual classroom practice, based on classroom observations and follow-up interviews with schoolteachers, Barnard observes and analyses teachers' commentaries. Her analysis reveals a correlation between computer activity and the teachers' classroom practice. She concludes that the computer activity needed to fit in with the teachers' classroom practice in order for teachers to see it as a valuable learning activity. On the other hand, teachers made adjustments to their classroom practices by incorporating computer activity, which had value in its own right.

This study provides valuable insights into the interaction between teacher, student and technology. Observations suggest software developers might benefit from greater awareness of teacher's classroom practice and greater consideration of the details about how their software would be used as part of the teaching session.

3.1.4 Anand and Zaimi: *Computer-managed instruction: Evaluation of alternative methods of technology integration in higher education* (2000)

The study by Anand and Zaimi (2000) relates directly to the current research in that they set out "to compare the impact of using alternate methods of technology in undergraduate and graduate classes". The methodology is based on adopting the concept of Usability Testing through a series of interviews within projects. This process followed a systematic method of assessing student needs and perspectives during the process of technology integration. Initially, user-friendly ways of technology integration were employed with little lecturing. Gradually, custom-designed software focussing on self-paced instruction and self-evaluation materials was used as an alternative to mainstream instruction (where little technology was employed). The entire focus of the project was aimed at reducing barriers to technology integration through regular feedback. Feedback responses were integrated into the programme as part of updating the instructional resources provided via technology. The results of continuous feedback revealed that in order to successfully integrate technology, differential needs of the traditional as well as adult learners need to be taken into account.

The strengths of this study are reflected in the findings: Students accessed technology more regularly than previously and educators therefore needed to combine traditional instruction with technology-related experiences in order to create a positive perception of technology.

3.1.5 Reid: *Towards effective technology education in New Zealand* (2000)

The new South African education framework is based to a large extent on the New Zealand model (SAQA 2000c). Since the former is a relatively new framework, it would be significant to consider the New Zealand perspective on technology education. Reid (2000) examines the historical concept of technology education in New Zealand, since its evolvement from the British model. He explains how England and Wales designed and introduced a new technology curriculum. New Zealand then needed to develop a technology curriculum suited to their developing culture. Reid focuses on the process of curriculum development, elaborating on good features and certain difficulties that resulted from the introduction of Technology as a discipline in 1999. His discussion is preliminary in nature and is an interim account of a process that will be undergoing changes well into the 21st century. Of his conclusions and recommendations, three are pertinent in the design of technology-based curricula (Reid 2000):

- Knowledge must constantly be acquired in order to understand and solve the problems of the time;
- The balance between *what to learn* and *how to learn* (within the subject specific discipline) must shift to the latter; and
- The success of the technology curriculum will depend upon its successful implementation in the schools, together with the development of an effective assessment programme.

The strength of Reid's research lies in the historical development of the technology programme in New Zealand, that it posits. This programme was devised and tailored to suit the needs of New Zealand. This could easily serve as a model for the South African context

– a working framework that takes into account South African needs against the backdrop of international trends and innovations.

3.1.6 Van Loggerenberg: *Implementing a problem-based learning model in the training of teachers for an outcomes-based technology curriculum* (2000)

A South African study that has direct implications on the current research is that by Van Loggerenberg who focusses on "preparing pre-service final year high school teachers in the natural sciences to facilitate learning in technology from an outcomes-based perspective" (Van Loggerenberg 2000: xvi). The study examines problem-based learning (PBL) as a curriculum design type in which the entire programme was structured around discipline specific problems that formed the basis for training pre-service teachers. The problems were diverse in nature, ranging from learner attitudes and motivation, to the depth and breadth of knowledge acquisition, to designing problem-based learning tasks. The rationale for employing the PBL approach was rooted in the following (Van Loggerenberg 2000: xvi):

- It is a strategy, which has the potential to operationalize OBE principles in learning environments.
- It is a strategy, which enhances that transferability of competence from university classroom to the real workplace because of its embedded characteristic of authenticity.
- The syntactical nature and structure of PBL and technology education show strong similarities.

The methodology employed, involved the development of a two-level OBE-PBL model that was used during the six-month training of pre-service teachers; then the pre-service teachers had to implement this model when they were required to facilitate learning in technology education in real schools for a month. Both quantitative and qualitative data were gathered from teachers and learners and the results revealed that pre-service teachers transferred their OBE-PBL competencies to such an extent that the post-test results of the experimental group were significantly better than their pre-test results. The post-test results of the experimental group were, however, not significantly better than the post-test results of the control group. In the final analysis, it became apparent that the experimental learners performed better in higher "cognitive questions that demanded meta-cognitive skills" (Van Loggerenberg 2000: xvii).

The strength of this study is that it represents a movement towards investigating the effectiveness of PBL as a curriculum renewal, teaching and learning strategy for OBE. An extensive background to OBE and various educational philosophies are examined during the study. Two limitations in this research are that it can only generalize the PBL approach to OBE in technology with regard to professional teacher training for OBE in the Technology and Science learning areas. Also, the researcher relied heavily on reports, questionnaires and conclusions by pre-service teachers, rather than extrapolating the data personally. This raises questions about the validity of data, because the researcher was not present during the full period of the pre-service teacher training sessions. Besides, the implementation with the pre-service teachers and learners needed to be extended over a longer period of time, which would probably yield more reliable and generalizable results.

3.1.7 Key emerging issues from studies outside of Music Technology

Although several issues and concepts are identified as being vital in the above review, only the concepts that have a direct impact on my study will be mentioned. The concepts that arise from the above studies are technology as a tool and Technology as a field of study. Most of the studies reviewed reflect technology as a tool to enhance the existing field of study, i.e. something that helps increase the pace of learning, experimentation, and so forth. Technology is seen as a vehicle to enhance existing teaching delivery systems, whereby cautions were expressed that teacher input in technology-based programmes is vital. Attitudes toward the use of technology are also vital for the implementation of technology education.

In Dixon's study Technology is treated as an area of study in its own right and conforms to disciplinary knowledge (as articulated in the disciplinary sciences of Physics, Chemistry and Biology), where the focus is on the production of knowledge. Van Loggerenberg who also focuses on disciplinary knowledge, highlights the need to examine problem-based learning within the OBE context, where the process of working toward understanding or resolution of a problem is important for the learner. The PBL approach implies a particular strategy for facilitating learning.

3.2 Studies in music

There are an increasing number of studies addressing curriculum design, combining technology and music and the introduction of electronic music into music education programmes. Unfortunately, due to the evolving nature of technology, many of these studies, although relevant, are already outdated in terms of their content because of the rapid development of technology itself. The principles that underlie the technology and the approach to technology are vital. Studies that are reviewed here are included because they were recently conducted and/or their findings are relevant and/or applicable to the field of Music Technology and qualification design in Music Technology in particular.

3.2.1 Faulk: *A curriculum guide designed to teach a basic knowledge of electronic music to undergraduate music education students* (1978)

Faulk's study is one of the earliest that addresses issues of curriculum design and electronic music. The purpose of his study was "to design a curriculum guide for a course that introduces prospective music teachers to a basic knowledge of electronic music" (Faulk 1978: 6). A primary objective of his study was to enable music education majors at USA institutions to teach electronic music effectively in grades four through twelve. Even twenty-four years ago, Faulk observed that the electronic music courses taught in some colleges and universities were designed with the composition or theory student in mind, where the prospective music educator, who was being educated to teach music in the public schools sector, was somewhat disadvantaged with a basic education in electronic music. Faulk based his research on the fact that the necessary hardware used in teaching a course in electronic music was relatively inexpensive and would be available in public schools.

Upon completion of a one-semester course in electronic music, data was collected through student questionnaires and the submission of final student compositions. Two of these student compositions were submitted to electronic music composers for evaluation. The curriculum guide devised by Faulk (1978: 50) was divided into six units:

1. Introduction to Electronic Music;
2. The Synthesizer;
3. The Tape Recorder and Manipulation Techniques;
4. Basic Compositional Techniques;
5. Electronic Music Compositions;
6. Using the Synthesizer to Teach Music.

Each of the units contained six facets: "exit level" student outcomes; acquired or basic content; suggested instructional procedures; materials and resources; evaluation; and supplemental reading.

Results showed that the students' knowledge of electronic music had increased notably after working through the six units. Furthermore, their competence had developed, enabling them to teach electronic music in grades four through twelve. Awareness of timbre sensitivity and musical structure, as well as an inclination to listen to all types of music also became apparent. Although this is a historically significant study in terms of being one of the earliest to design a curriculum guide for electronic music, the sample of students (six) was limited.

3.2.2 Sanders: *The effect of computer-based instructional materials in a programme for visual diagnostic skills training of instrumental education students* (1980)

Sanders was one of the influential early researchers who implemented computer-based instruction (see Chapter 3.3.1.4). His study set out "to determine the effect of computerized instruction on the ability of students to perform tasks of visual error-detection during instrumental methods-instruction in music" (1980: 6). The study was based on a post-test design; initial biases between the groups were reduced through a process of randomization. Twenty instrumental music method students were targeted for study. These students were divided into a control group and an experimental group. The control group utilized resources in a classroom setting under teachers' supervision, whereas the experimental group used similar materials in a computerized format without supervision, outside of the classroom.

Both groups had to perform visual error detection (no aural detection used) on an instrumentalist (saxophonists, flutists, and the like) according to preset criteria. The post-test was administered to both groups simultaneously. The attitude questionnaire was only completed after six weeks and each candidate participated in two interviews with the researcher (1980: 6).

On analysis of the broad research problem, certain research questions surfaced (Sanders 1980: 6):

- Within the parameters of the test group what association exists between practice and post-test score achievement?
- What was the correlation in the attitudes of the two groups toward the instruction they had received?

- And what was the relationship between student scores on the post-test and student attitudes in relation to the instruction among the selected groups?

The results of this study were derived from comparative post-test scores, practice times and the number of practice items completed. These results revealed that computer-aided instruction provided a highly effective and efficient method of delivering visual diagnostic skills instruction (Sanders 1980: 83). Student attitudes toward the integration of technology were positive. However, they also indicated that the learning process could be enhanced through additional teacher interaction (1980: 91). The weakness of this study lies in three areas:

- No attempts were made to compare the costs with regard to instructional computing versus conventional teaching;
- The instructional materials focus was on visual error detection only and avoided aural detection; and
- The researcher combined the effect of individualization (subjective opinions) and computerization (data extracted through the use of computers) instead of treating them as separate variables of the study.

3.2.3 Grijalva: *Factors influencing computer use by music educators in California independent elementary and secondary schools* (1986)

In 1986, Grijalva conducted a study that examined computer use in the curricular area of Music, with the intended purpose of assessing the status of computer use by independent school music educators in California, and identifying factors that influence such use (1986: 2). His study was based on the premise that independent schools were leaders when it came to allowing students computer access, while the integration of computers throughout the broader school curriculum remained an identified but unfulfilled goal.

Grijalva implemented a survey research design, using over one hundred music educators who were in the employ of 104 member schools in the California Association of Independent Schools during April of 1986. A return rate of 80% on the original sample was obtained.

The results of his findings with regard to music educators indicate that 38% of educators used computers for multi-purposes, administration and instruction; 26% used computers for instructional activities; and among the non-users, half were in the orientation and preparation status of computer use.

In this study, eighty factors relating to the effect of computer use were identified and statistically tested. Of these factors, thirty-seven were identified as significant influences, with the following being major influences: personal (gender, ownership, and the like), equipment and access, financial, instructional support, and curricular.

This study is relevant because it shows that computer use is not uncommon by music educators for tasks other than music. The integration of the computer into the Music curricula would be a challenge to curriculum designers and music educators alike.

The strength of this study lies in the correlation between the factors identified and the use of computers by music educators. However, for the purpose of my study the conclusions reached by Grijalva are not useful because they are based on a defined population. Besides, no attempt was made to ascertain whether higher levels of computer use were, in fact, desirable.

3.2.4 Fábregas: *Designing and implementing an electronic music program in a community music school in New York City* (1992)

The study undertaken by Fábregas provides guidelines for community music schools on how to design and implement an electronic music programme (1992: 12). This study was based on a pilot project at a summer camp, designed to introduce twenty-three children between the ages of six and fourteen of different musical levels and abilities to electronic instruments and ensemble playing.

The children were introduced to three types of electronic instruments (Casio DH 100 and DH 500 wind controllers, Kawai 50 WK keyboards and Yamaha DD5 drum pads). The children learnt to play each instrument while at the same time majoring in one of the instruments. Children with differing musical abilities were accommodated. Summative evaluations were based upon:

- Questionnaires and surveys filled out by students, parents and faculty;
- Live and tape recorded researcher moderated observations; and
- Oral teacher reports during staff meetings.

The results showed increased interest among students and teachers in the electronic instruments due to their accessibility and their novel features (such as interesting timbres). The electronic instruments also allowed the children to:

- Learn at an increased pace without having to grapple with technical problems that so often occur with acoustic instruments;
- Participate in the final ensemble performance after four weeks of preparation; and
- Improve their practising habits by motivating them to learn music.

The results in this study are similar to those of Grijalva (1986), in that the research is confined to a defined population at a specific summer camp. So the generalizability of findings would be questionable. Only issues pertaining to individual and ensemble performance are addressed, without actually introducing students to the principles of electronic music. On a positive note, the interest shown by the parents and the students toward electronic music paves the way for music educators considering to incorporate technology into mainstream music programmes.

3.2.5 Tredway: *A curriculum for the study of audio, video, computer, and electronic music technology for undergraduate music education majors based on a survey among members of the Florida Music Educators Association* (1994)

The Music Educators National Conference (MENC), the largest music educator body in the USA, has been in favour of the uses of technology by music educators, both for instructional and non-instructional purposes. With this policy as a foundation for music education also supported by the Florida Music Educators Association, Tredway (1994) sets out to provide undergraduate music education majors with a course of instruction by which fundamental knowledge and skills concerning audio, video, computer and electronic music devices can be attained (Tredway 1994: 6). In order to ascertain the most frequently used audio, video, computer, and electronic music devices and their applications, he developed a survey instrument and a panel of five music education professionals used a test/re-test method to evaluate this instrument for its validity (Tredway 1994: 104). A sample of 400 questionnaires was sent to members of the Florida Music Educators Association, to which 188 (47%) responded. The data received was analyzed according to the test/re-test method, after being subjected to four different types of treatment (Tredway 1994: 105):

- Mean responses;
- Mode for each item;
- Numerical responses that were ranked and correlated for each item; and
- Numerical responses that were ranked and correlated using the Spearman-rho formula[18] adjusted for tied scores.

This process was followed by the compilation of a curriculum providing basic skills and concepts for undergraduate music education majors in the areas of audio, video, computer and electronic music instrument technology. A panel of six education and music education professionals using a six point Likert-type scale[19] evaluated the subsequent curriculum. Two items following the evaluation attained a mean score below the acceptable minimum of 4.0, which required revisions of sections of the proposed curriculum (Tredway 1994: 106). Therefore, instructional activities were added to the curriculum, which reflected the commentaries of the evaluators.

Tredway's study provides good groundwork in laying the foundation for curriculum content and an approach to evaluating student's progress regarding audio, video, computer and electronic Music Technology. The issues of curriculum content and evaluation procedures inform the present study. The two weaknesses I identified lay in the construction of the curriculum: the curriculum must reflect the twenty-three survey items identified by the survey for their implementation into the curriculum, and the curriculum should not exceed ten hours of instructional time.

3.2.6 Jaeschke: *Creating music using electronic music technology: curriculum materials and strategies for educators* (1996)

Jaeschke's study (1996) was similar to that of Faulk (1978) and Fábregas (1992) in addressing the issue of curriculum studies using electronic Music Technology. As is evident in Fábregas' title (Chapter 3.2.4), the terms "electronic music" and "music technology" are used together (see Chapter 2.3), suggesting some kind of relatedness between the two areas. This is also particularly evident in Jaeschke's title. This study is one of the first to use the term "music technology" to denote a specific component of formal music studies.

[18] A formula used for the measurement of the correlation between two variables.

[19] A measurement scale used to obtain information by means of question and answer.

The purpose of Jaeschke's study was to create and field-test a concept-based creative music curriculum that would enable teachers to teach music while integrating electronic Music Technology into the classroom (1996: 4). Jaeschke based his hypothesis on the notion that "technophobia", financial concerns, and the absence of current curriculum materials were factors hampering the introduction of electronic Music Technology in the classroom. Jaeschke uses the creative music approach developed by the Manhattanville Music Curriculum Project (MMCP). A hands-on exploratory approach is the unifying component with the MMCP and Jaeschke's approach in teaching the fundamental concepts of music.

The study details the technological process involved in four areas of technology, namely

- Tape recording;
- Both open reel (*Musique Concrète*) and cassette multitrack;
- MIDI computer sequencing; and
- MIDI notation,

by means of strategies contained in eleven musical sequences. Although *Musique Concrète* by its very nature is interdisciplinary, the integration of the remaining three areas of technology suggests a move towards interdisciplinary knowledge production (i.e. computers, music and sound engineering). Gibbons and co-authors refer to interdisciplinary knowledge production as Mode 2 knowledge production (Gibbons *et al* 1997: vii).

Jaeschke conducts an extensive review of related material, listening examples and references, which he finds should form an integral component of the curriculum. Results of the study were obtained through a field test and questionnaire that were completed by professional music educators. Jaeschke presents a summarized report that includes suggestions and revisions regarding the effectiveness and feasibility of the project.

Jaeschke's study excludes certain pivotal areas of music technology, namely hard-disk recording, computer-based software teaching music theory, aural training, jazz improvisation and instrumental instruction, sound design and computer music. Jazz improvisation is important in that the musical freedom encountered in this genre lends itself towards composition and creativity when using music technology as a tool. However, this study impacts to an extent on my study in that it is designed to meet the nine national content standards[20] proposed by MENC (Pre-grade one to grade twelve) for music education. These standards are (MENC 1994a):

1. Singing, alone and with others, a varied repertoire of music.
2. Performing on instruments, alone and with others, a varied repertoire of music.
3. Improvising melodies, variations and accompaniments.
4. Composing and arranging music within specified guidelines.
5. Reading and notating music.
6. Listening to, analyzing and describing music.
7. Evaluating music and music performances.
8. Understanding relationships between music, the other arts and disciplines outside the arts.
9. Understanding music in relation to history and culture.

Although these content standards apply to the school music programme, they impact on the design of teacher training courses at post-secondary institutions. Prospective music educators are required to teach and assess against these standards; therefore these standards are pivotal in teacher training.

Since South African qualifications need to be internationally benchmarked (see Chapter 5.3.1.9), the Technology Institute for Music Educators (USA), who use these content standards in the design of their technology programmes, provide the ideal mechanism through which such benchmarking is possible.

3.2.7 Regenmorter: *Integrating technology into the music curriculum of a California community college* (1998)

The issue of integrating technology into the music curriculum is also addressed in Regenmorter's study. In this study, Regenmorter determines how Music Technology can be implemented in the educational setting. The question of what constitutes Music Technology, how it developed, and some objections to its use were examined (1998: 3-4).

Regenmorter focused on the community college setting and based his investigation on a study of periodicals, books, case studies, surveys and curricula of music departments that justified the use of specific technologies within their programmes. The current use of

[20] The use of the term standard, as used in this research, is not consistent internationally. MENC (USA) uses the term standard to suggest broad abilities required of learners rather than a particular level of achievement..

available technology at the American River College was examined. This was achieved through personal observations, interviews, a technology usage survey and documenting of all music technology equipment, software and peripherals that the department owned. Regenmorter offers particular strategies and models on how to effect the integration. The particular strength of Regenmorter's study lies in its literature review. The study programme suggested is limited, however, to just one specific situation and does not suggest itself as a model for other institutions of higher learning. Regenmorter's study benefits this current research in that it addresses the issue of integrating Music Technology, an emerging field of study, into the post-secondary music education curriculum. Also the strategies and models with regard to the integration of Music Technology inform the design of the qualification in Chapter 5.3.

3.2.8 Key emerging issues from studies in Music Technology

My review of studies in Music Technology suggests that most research in this field is being undertaken in the USA, where much of society as a whole is technology driven. It is apparent from the studies presented in the previous section, that several technology programmes are targeted at the music educator. This can be deduced from the use of the words music educator, music education, curriculum, schools, and so forth, in the titles of the studies reviewed. The emphasis placed on curriculum in most of the studies above highlights the need to introduce Music Technology into the existing music programmes at education institutions.

The two broad issues that arise from the previously mentioned studies are those surrounding curriculum transformation (the integration of technology into existing music programmes) and those dealing with content (knowledge). Curriculum transformation to accommodate emerging knowledge production (technology-based in the cases mentioned) needs to be addressed by music educators internationally. The boundaries of traditional disciplines need to be reviewed. With regard to content issues, I have identified the following components of the field of Music Technology, reinforcing the findings in Chapter 2.2 and 2.7:

- Electronic music;
- Electronic musical instruments;
- Audio technology; and

- The use of the computer as a tool that aids the process of composition and data processing (e.g. in the case of sequencing).

The description and application of Music Technology in the afore-mentioned studies suggest a general shift from disciplinary (Mode 1) to interdisciplinary (Mode 2) knowledge production. Mode 2 knowledge production operates within a context of application, in that problems are not set within a disciplinary framework. The Mode 2 knowledge, as is the case with Music Technology (music + technology), is in a non-hierarchical and heterogeneously organized form, in which the technology but not the principles (basics) are constantly changing.

Since Music Technology is a relatively new field in South Africa, texts and source material are generally informative, but do not always facilitate the design of curricula. However, an increasing number of writers, especially internationally, are paying attention to issues of curriculum design and learning programmes. As can be deduced from the studies discussed earlier, although areas of common ground exist, issues pertaining to curriculum design are often specific to the needs of particular learning environments and contexts. The issue of relevance is a vital consideration in the Music Technology programme design.

3.3 Post-secondary trends in Music Technology internationally

In order to establish current international trends in Music Technology, data were gathered and examined from Internet websites of post-secondary institutions that offered programmes in Music Technology. This data was used to ascertain what were the perceptions of post-secondary institutions internationally on the nature and status of Music Technology. The data did not trace links to other departments within the institutions that purported to offer Music Technology components. E-mail correspondence was also maintained with the programme coordinators who were willing to share structural and content composition of their programmes and comment on any ancillary information that was deemed necessary to my study. The primary purpose of this analysis was to establish trends relating to the various Music Technology components that were offered within each of the various programmes/ qualifications. The secondary purpose included ascertaining any interdisciplinary correlation existing between Music Technology and other disciplines and viewing the impact of Music Technology on career paths in music. Although this approach to data gathering is valid, it is, however, not intended for generalizations or as the only way to make conclusions about Music Technology's profile internationally.

3.3.1 Core components of Music Technology

The selection criteria for inclusion in the analysis required each institution to be a post-secondary institution and to have at least one Music Technology programme (degree, diploma, certificate, short course, semester course, and so on), offering a minimum of two Music Technology components (identified in Chapter 2.7). Following an online search of music programmes at various institutions, a total of fifty-five institutions (including South African institutions) were identified for inclusion in the analysis. All fifty-five institutions met the required selection criteria. According to the historical development of technology (see Chapter 2.2) and the summary provided in Chapter 2.7, ten components have been identified as central to the development of Music Technology (these are discussed below at Chapter 3.3.1.1 to 3.3.1.10 - the brackets indicate abbreviations). Apart from these ten core components some institutions offered other areas of Music Technology (acoustic instrument design, television and film, music adventures and games, programmed instruction, and teaching machines) as part of their programme.

3.3.1.1 Electronic Musical Instruments (EMI)

These are musical instruments that generate sounds electronically rather than acoustically. The range of these instrument types includes controllers, sound modules, synthesizers, digital pianos, vocal processors and samplers. Traditionally, tape recorders were also considered as electronic musical instruments. However, electronic musical instruments refer specifically to sound generation, synthesis, sequencing and arrangement rather than reproduction.

3.3.1.2 MIDI Sequencing (MS)

This is a digital process whereby the information sequences of a musical performance (note-on/off, tempo, dynamics, pitch, timbre, and the like) are captured by a computer/hardware device, processed and stored for purposes of further processing and/or output. The types of capturing techniques may differ, depending on the devices used. All sequencers these days are either software- or hardware-based.

3.3.1.3 Music Notation (MN)

This component refers to the processing of music notation by means of computer software as opposed to the traditional process of a printing press. Music software is designed to print scores, extract and transpose individual parts, scan scores and generate MIDI performances. Once the music data have been entered into a software programme, this data can then be transformed according to one's specific requirements.

3.3.1.4 Computer-based Education/Instruction/Training (CBE/I/T)

The computer and software are utilized for the purpose of supporting music education. These software programmes are tailored toward specific needs of the developing/ professional musician. They are used for music theory instruction, music history and analysis, developing ear-training skills, creation of accompaniment tracks, as well as drill and knowledge testing in a variety of areas in music and music education. Computer-based education is central to the development of Music Technology because it impacts on most aspects (teaching, learning, recording, evaluating, testing, amongst others) of music education.

3.3.1.5 Multimedia and Digitized Media (MDM)

This component refers to the integration of sound, text, graphics, animation and video in digital format. The primary focus is on using the computer and other hardware devices to create, manipulate, store and combine various media objects such as text, audio, video and graphics into a single presentation.

3.3.1.6 Internet and Telecommunications (IT)

As is the case with several disciplines using current technology, musicians are also introduced to the various digital formats, protocols, and access and design procedures that are associated with the digital transfer of data and the Internet. A large proportion of the music produced, archived and distributed today is accessible via the Internet (Mash 1999).

3.3.1.7 Computers, Information Systems and Lab Management (CISLM)

The computer has become a valuable tool not only for its use in music, but also for the added value it brings to musicians in general. Computers help educators manage information more effectively in their everyday lives. Some of the functions range from word processing, working with databases and spreadsheets, desktop publishing, presentations and an integration of laboratory equipment within their working environments.

Managing a technology facility, whether it is a single computer with a MIDI workstation or a full Music Technology multi-lab, requires administrative and management abilities. This would be combined with installing, upgrading software and maintaining systems. At a more advanced level an understanding of the configurations for electronic musical instruments, computers, MIDI interfaces, sound reinforcement, projection systems, sound and data networking, and how they interact with each other is vital. A knowledge of these issues will enable the Music Technologist to be better prepared to effectively integrate and manage music technology installations.

3.3.1.8 Computer Music (CM)

Computer Music refers to the computer as a musical instrument that generates (creates) and synthesizes sounds and acts as a partner (accompanist/soloist) in live performance. The emphasis in computer music is on the exploration of new sound parameters and compositions through technological means. Since music processing tends to dominate most technology-based programmes, Computer Music, in the Music Technology domain, addresses the issues surrounding music synthesis and creation.

3.3.1.9 Audio Technology (AT)

The term "Audio Technology", used by Tredway (1994:12), denotes an area of Music Technology that includes devices that allow for the recording, mixing, processing, mastering and/or playback of sound. Examples include, but are not limited to, magnetic and digital tape recorders, phonographs, harddisks and compact disc players. Equipment necessary for the amplification of sound (microphones, processors, amplifiers and loudspeakers), together with the techniques associated with sound recording, processing, duplication and distribution, is also included. This area of study is also commonly referred to as Sound Engineering.

3.3.1.10 Research in Music Technology (R)

The focus of a research component at the post-secondary (predominantly undergraduate level) is to familiarize learners with various research techniques and designs in Music Technology and to create new knowledge. The process involves the interpreting and extrapolation of research information from published sources. These techniques are examined with a view to formulating research questions, engaging in critical discourse and developing appropriate research topics. The initial research skills are generic ones with other fields of study. However, advanced research in Music Technology could follow to include research into areas such as surround sound (for example, room acoustic modelling using two/three dimensional wave-guide mesh structures; surround sound techniques and reverberation modelling), performance and synthesis (for example, neural control of music synthesis, interactive media spaces), computer music (for example, the study of grammars in music, stochastic/algorithmic composition), and the like. From this point on, this component will be referred to as Research.

Using the information presented in Chapter 3.3.1, an overview of international Music Technology components has been documented in Table 3.1 and Figure 3.1. The reasons behind this tabulation are to ascertain the spectrum of focus areas in Music Technology internationally, and not to analyze detailed programmes in countries that are technologically advanced in terms of the usage of and research into technology. The listing of the fifteen countries follows no preferential order, because this does not affect the nature of data. The sample taken was random and not limited to a specific number of programmes/components or certification offered in each country. In addition to providing an analysis of the most commonly offered Music Technology components within these programmes, it provides a logical point of departure for the establishment of any new Music Technology qualification that curriculum developers may be anticipating. Since all of the South African music institutions offering Music Technology are examined in Chapter 3.4, I sampled ten out of the seventeen institutions which I considered an adequate quota (59%) for the international sample.

The core components listed in Figure 3.1, which follows, correspond to the abbreviations used in this section, namely: Electronic Musical Instruments (EMI), MIDI Sequencing (MS), Music Notation (MN), Computer-based Education/Instruction/Training (CBE), Multimedia and Digitized Media (MDM), Internet and Telecommunications (IT), Computers, Information

Systems and Lab Management (CISLM), Computer Music (CM), Audio Technology (AT) and Research in Music Technology (R).

Table 3.1: International areas of focus regarding Music Technology core components

	Electronic Musical Instruments	MIDI Sequencing	Music Notation	CBE, CBI, CBT	Multimedia & Digitized Media	Internet & Telecommunications	Computers, Info-Systems, Lab Management	Computer Music	Audio Technology	Research
Australia										
Australian Centre for Arts and Technology (Austr. Nat. Univ.)	●	●			●	●	●	●	●	
Griffith University		●			●		●	●	●	●
Macquarie University	●	●			●	●	●		●	
Monash University	●	●	●				●			
Queensland University of Technology - B Mus	●	●			●			●	●	
Deakin University (Non-degree course: Art E Mus)		●	●	●	●	●				
University of Western Sydney		●						●	●	
James Cook University	●	●	●				●		●	
New Zealand										
Victoria University of Wellington	●	●			●	●		●	●	
University of Auckland	●	●	●					●	●	
University of Waikato	●	●	●				●	●	●	
University of Otago	●	●				●		●	●	
University of Canterbury	●		●	●	●			●	●	
Asia and Middle East										
University of Putra Malaysia	●	●	●		●			●	●	●
Theremin Centre for Electro-Acoustic Music, Moscow	●	●	●		●	●	●	●	●	●
University of Hong Kong	●	●	●	●		●		●	●	
Tel Aviv University		●	●					●		
Bahr-Ilan University (Israel)	●	●	●	●		●		●	●	

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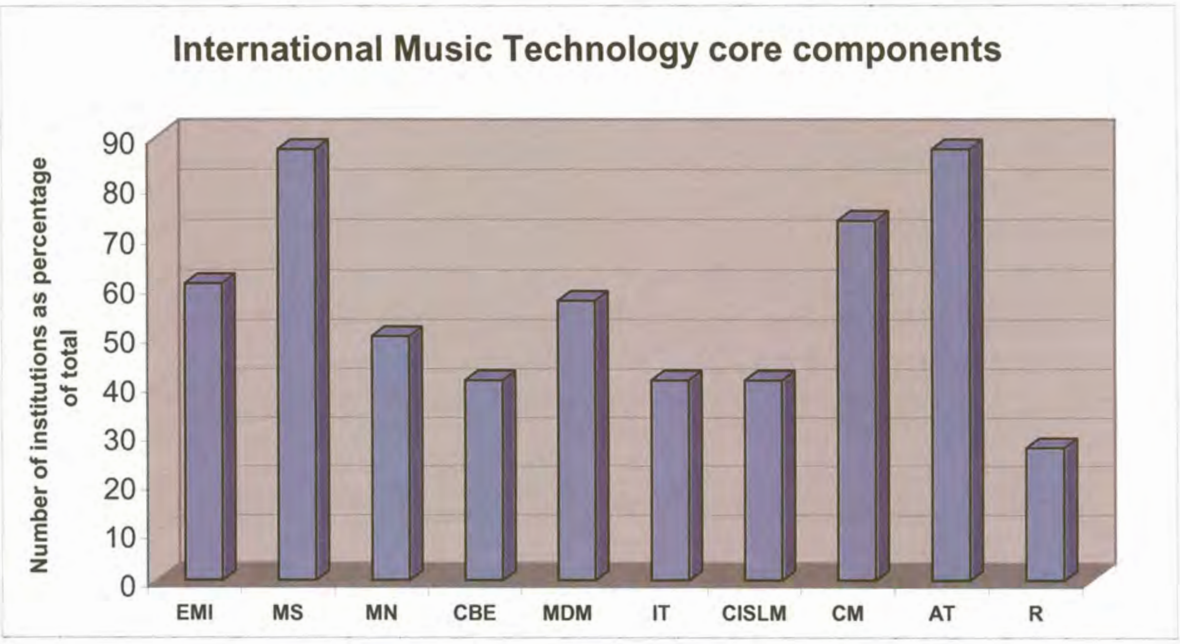
Table 3.1 (continued)

	Electronic Musical Instruments	MIDI Sequencing	Music Notation	CBE, CBI, CBT	Multimedia & Digitized Media	Internet & Telecommunications	Computers, Info-Systems, Lab Management	Computer Music	Audio Technology	Research
USA and Canada										
Berklee College of Music	●	●	●	●	●	●	●	●	●	●
Duquesne University	●	●	●	●	●	●		●	●	
Indiana University	●	●	●	●	●	●	●	●		●
Princeton University								●	●	●
Queen's University (Canada)	●	●		●	●	●	●	●	●	
Radford University	●	●		●	●			●	●	
Temple University	●	●	●		●	●	●	●	●	
Northwestern University	●	●	●	●	●	●	●	●	●	●
University of Northern Colorado	●	●	●	●	●		●	●	●	
University of South Carolina		●	●	●				●	●	
South Africa										
Rhodes University		●	●			●	●		●	
Technikon Natal		●							●	
Technikon Pretoria		●		●			●	●	●	
UNISA (University of South Africa)		●	●		●				●	
University of Cape Town		●			●			●	●	●
University of Natal-Durban		●	●		●	●	●	●	●	
University of Port Elizabeth		●	●		●		●		●	
University of Potchefstroom		●	●		●					●
University of Pretoria	●	●	●	●	●	●	●	●	●	●
University of Stellenbosch		●	●			●	●	●	●	
United Kingdom										
De Montfort University	●	●						●	●	
Keele University	●	●		●	●			●		
Leeds Metropolitan University		●		●	●	●	●		●	
University of Edinburgh	●	●		●	●			●	●	
University of Hull	●					●		●	●	
University of Kent	●	●	●			●		●	●	
University of Southampton		●	●						●	
University of Surrey		●						●	●	●
University of Sussex				●	●				●	
University of York	●	●		●	●	●	●	●	●	●
Europe										
FH Furtwangen – Hochschule für Technik und Wirtschaft	●			●	●		●		●	
Hochschule für Film und Fernsehen, Potsdam		●			●				●	
IRCAM Centre Pompidou, Paris	●	●	●	●	●			●	●	●
St Patrick's College, Maynooth, Ireland		●		●			●	●		
Royal Conservatory, The Hague, The Netherlands	●	●		●				●	●	
SAE Technology College, Paris	●				●	●		●	●	●
Technical University of Wroclaw, Institute of Telecom, Poland	●	●						●	●	●
Total number of institutions	34	49	28	23	32	23	23	41	49	15
Percentage	60.7	88	50	41.1	57.1	41.1	41.1	73	87.5	27.2

Figure 3.1: Weighting of Music Technology core components internationally



All institutions offered a minimum of two of the above specialization areas. Music Sequencing and Audio Technology were the most widely offered components, with 88% of all reviewed institutions offering these components. Computer Music was the next most widely offered area with 73% of all institutions, followed by Electronic Musical Instruments (61%) and Multimedia and Digitized Media (57%). Approximately 41% of all reviewed institutions offered the following components: Music Notation, Computer-based Education/ Instruction/Training, Internet and Telecommunications, and Computers, Information Systems and Lab Management. The area that was least offered by the reviewed institutions was Research in Music Technology (offered by only 27% of the institutions). While some institutions offered a minimum of two components, others offered all ten components.

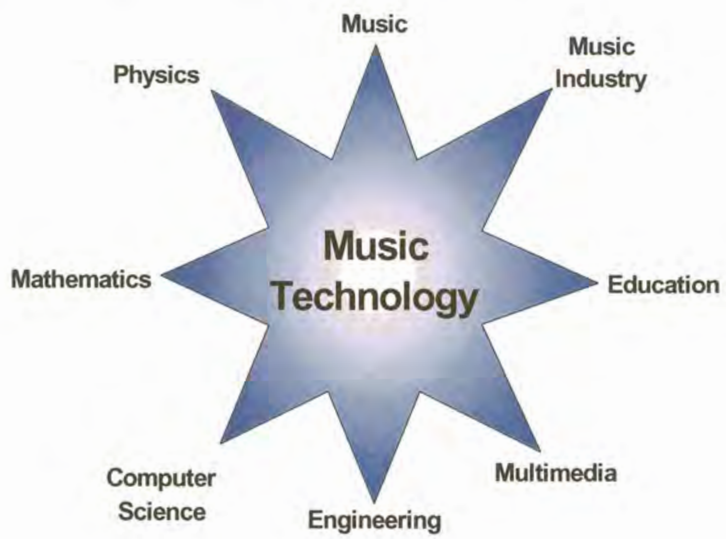
The bar graph presented in Figure 3.1 above reflects the weighting of the core components that make up the field Music Technology. These components reflect the highest frequency in Music Technology programmes around the world. The core components identified above concur with the core components identified in Chapter 2.7.

3.3.2 Cross-curricula interaction

The data captured in the previous section (Chapter 3.3.1) were analysed with regard to core areas of focus, cross-curricula disciplines and music career opportunities. The core areas of focus (core components or components) have already been discussed (Chapter 3.3.1). This section will focus on the cross-curricular disciplines/areas and music career paths.

A close analysis of the content of Music Technology components shows that there is a cross-curricula inter-relationship between Music Technology and other disciplinary and professional areas. The relationship between Music Technology and these areas is illustrated in Figure 3.2.

Figure 3.2: Cross-curricula interaction of Music Technology and eight other areas



Each of these eight areas already has components that share common knowledge content (critical core areas) with Music Technology. Table 3.2 that follows maps the cross-curricula and critical core areas to the relevant components in Music Technology.

Table 3.2: Relationship between cross-curricula areas and Music Technology components

Cross-curricula area	Critical core area	Music Technology components
Music (as a sub-field)	• Performance • Aural training • Notation • Genre • Composition and Harmony • Form and Analysis • Music Theory • Research • Orchestration and Instrumentation • Arranging	• Electronic Musical Instruments • MIDI Sequencing • Music Notation • Computer Music • Audio Technology • Research
Physics	• Physics of sound (Theory of propagation) • Acoustics • Basic circuit theory	• Electronic Musical Instruments • Computers, Information Systems and Lab Management • Computer Music • Audio Technology • Research
Mathematics	• Numerical Systems: Decimal, Binary, Hexadecimal • Geometry	• MIDI Sequencing • Multimedia and Digitized Media • Computers, Information Systems and Lab Management • Audio Technology • Research
Computer Science	• Informatics • Hardware/Software • Programming • Internet • Human computer interaction	• Multimedia and Digitized Media • Internet and Telecommunications • Computers, Information Systems and Lab Management • Computer Music • Research

continued overleaf

Table 3.2 (continued)

Cross-curricula area	Critical core area	Music Technology components
Engineering	• Sound Synthesis • Digital Signal processing • Digital Audio • Hardware interfaces	• Electronic Musical Instruments • Multimedia and Digitized Media • Internet and Telecommunications • Computers, Information Systems and Lab Management • Computer Music • Audio Technology • Research
Multimedia	• Graphics • Animation • Video • Text • Sound • Human Computer Interaction • Instructional Design	• Midi Sequencing • Computer-based Education • Multimedia and Digitized Media • Audio Technology • Research
Education	• Teaching • Research • Training • Computer-based instruction • Edutainment	• Electronic Musical Instruments • MIDI Sequencing • Music Notation • Computer-based Education • Research
Music Industry	• Film Industry • Plays and Musicals • Television • Entertainment • Copyright • Marketing and Merchandising • Music Production	• Electronic Musical Instruments • MIDI Sequencing • Multimedia and Digitized Media • Internet and Telecommunications • Computer Music • Audio Technology • Research

The learning content within these cross-curricula areas impacts on the components of Music Technology. It should be mentioned, however, that in some cases (e.g. Engineering and hardware interfaces) this interrelatedness might be superficial. The overlapping of learning content illustrates the inter-relatedness between the various disciplines/areas. It needs to be mentioned at this point that qualification design based on the principle of inter-relatedness supports the NQFs transformational OBE (see Chapter 4.2.3) agenda that is underpinned by critical cross-fields (SAQA 2000a: 3).

3.3.3 Music career paths and Music Technology components

With data extracted from the international trends in preceding sections, I overviewed and mapped (Table 3.3) the possible career paths available in the Music Industry[21] internationally. The reason the international market was used as the basis for data in this section stems from the fact that several of these careers paths are not yet available locally. South Africa, with its new education structure, strives toward these international trends. Given the pace of change internationally, it is just a matter of time before these trends manifest themselves nationally as well.

In Table 3.3 the mapping correlates the broad and specific career direction opportunities with the core components (discussed in Chapter 3.3.1). The mapping highlights the interaction and relationship between Music Technology components and the Music Industry. It needs to be pointed out that not all core components manifest themselves in all of the career specializations. Certain career directions require a greater or lesser interaction with the core components. The careers in this table are not a complete listing of all possible careers in the Music Industry, but rather an overview of the primary ones (as identified in Appendix C). The careers have been grouped into broad career paths (career direction).

Table 3.3: Music career paths and their relationship to Music Technology core components

Broad career paths	Career specialization	Music Technology core components
Performance	• Vocalist/Instrumental Soloist • Session Musician • General Business Musician • Performing Artist • Orchestral/Group Member • Background Vocalist • Floor Show Band	• Electronic Musical Instruments • MIDI Sequencing • Music Notation • Computer-based Education • Audio Technology • Research

[21] A list from the South African Music Directory, which also identifies career opportunities, is provided in Appendix C.

Table 3.3 (continued)

Broad career paths	Career specialization	Music Technology core components
Songwriting	• Composer • Jingle Writer • Lyricist • Producer/Songwriter • Singer/Performing Songwriter • Staff or Freelance writer	• Electronic Musical Instruments • MIDI Sequencing • Music Notation • Computer-based Education • Audio Technology
Music Production and Engineering	• MIDI Engineering • Music Director • Producer • Programme Director • Recording Engineer • Studio Director or Manager	• Electronic Musical Instruments • MIDI Sequencing • Music Notation • Computer-based Education • Multimedia and Digitized Media • Internet and Telecommunications • Audio Technology • Research
Music Synthesis	• MIDI Technician • Programmer • Performing Synthesist • Music Sequencer • Sound Designer • MIDI Engineer	• Electronic Musical Instruments • MIDI Sequencing • Music Notation • Computer-based Education • Multimedia and Digitized Media • Audio Technology • Research
Film Scoring	• Film Composer • Music Editor • Music Supervisor/Director • Film Arranger/Adapter • Film Conductor • Film Music Orchestrator • Synthesis Specialist • Theme Specialist	• Electronic Musical Instruments • MIDI Sequencing • Music Notation • Multimedia and Digitized Media • Computer Music • Audio Technology • Research

continued overleaf

Table 3.3 continued

Broad career paths	Career specialization	Music Technology core components
Contemporary writing and Production	• Arranger • Composer • Conductor • Copyist • Jingle Writer • Orchestrator • Record Producer • Teacher • Transcriber • Publishing Editor	• Electronic Musical Instruments • MIDI Sequencing • Music Notation • Computer-based Education • Multimedia and Digitized Media • Computer Music • Audio Technology • Research
Music Education	• Choir Director • Post-secondary Music Educator • School Music Educator • Music Supervisor • Private/Public School Instructor	• Electronic Musical Instruments • MIDI Sequencing • Music Notation • Computer-based Education • Multimedia and Digitized Media • Internet and Telecommunications • Computers, Information Systems and Lab Management • Audio Technology • Research
Music Therapy	• Private Music Therapist • Hospital Music Therapist • Nursing Home Therapist • Correctional Facility Therapist	• Electronic Musical Instruments • Computer-based Education • Multimedia and Digitized Media • Internet and Telecommunications • Computers, Information Systems and Lab Management • Research
Professional Music and Music Business/ Management	• Advertising Executive • Booking Agent • Business Manager • Field Merchandiser • Music Publisher • Personal Manager • Professional Manager	• Electronic Musical Instruments • Internet and Telecommunications • Computers, Information Systems and Lab Management • Research

continued overleaf

Table 3.3 (continued)

Broad career paths	Career specialization	Music Technology core components
Tours/Road Work	• Road Manager • Sound Technician • Tour Coordinator • Tour Publicist	• Electronic Musical Instruments • Internet and Telecommunications • Computers, Information Systems and Lab Management • Research
Record Companies	• Artist & Repertoire Administrator • Artist & Repertoire Coordinator • Campus Representative • Consumer Researcher • Director of Publicity • Marketing Representative • Public Relations Officer • Publicist • Regional Sales Manager	• Computers, Information Systems and Lab Management • Internet and Telecommunications • Research
Music Researchers	• Musicologist • Ethnomusicologist • Archivist • Librarian • Music Historian	• Music Notation • Computers, Information Systems and Lab Management • Multimedia and Digitized Media • Internet and Telecommunications • Research
Music Related Jobs	• Multimedia team member • Editor • Music Consultant • Educational Planner • Artist Manager • Instrument repair • Piano Tuner • Press Agent • Product Demonstrator • Talent Agent • Clinician • Merchandiser	• Electronic Musical Instruments • MIDI Sequencing • Music Notation • Computer-based Education • Multimedia and Digitized Media • Internet and Telecommunications • Computers, Information Systems and Lab Management • Audio Technology • Research

continued overleaf

Table 3.3 (continued)

Broad career paths	Career specialization	Music Technology core components
Other	• Radio Disc Jockey • Instrument Sales Representative • Intern • Music Shop Manager • Music Shop Salesperson • Musical Instrument Builder/Designer • Record Shop (or Department) Manager • Record Shop Clerk • Computer Music Programmer • Music Critic/Journalist	• Electronic Musical Instruments • MIDI Sequencing • Computer-based Education • Multimedia and Digitized Media • Internet and Telecommunications • Computers, Information Systems and Lab Management • Research

It is apparent from Table 3.3 that Music Technology has a role to fulfil in most music or music-related careers. In some instances, like Recording Engineering, the role might be substantial, whereas in others (e.g. a Booking Agent) this might be superficial through the use of basic technologies (Internet, Web-design, Computer usage, and the like). In each of the broad career paths listed, no less than three core Music Technology components manifest themselves. It should also be added that MENC (2001) lists Music Technology as a specialized area of music study, with three identifiable career paths: Multimedia Publishing, Sound and Video Editing, and Technology-based Music Instruction Design. The above listed music career paths (Table 3.3) are not mentioned by MENC. It could be assumed, though, that these career paths are recognized because seven (Audio Technology, Research and Computer Music are omitted) out of the ten core components are identified as core components by MENC with regard to the study of music.

Additional information, extrapolated from the international Music Technology trends in Chapter 3.3, indicates the following international trends (in no specific rank order):

- With few exceptions (for example, Berklee College of Music, University of York and IRCAM), formal Music Technology qualifications at most institutions were non-existent a decade ago.
- Music programmes are showing an increased use of technology within existing programmes.

- There is an increase in the number of educational institutions offering Music Technology.
- Several Music Faculties/Departments offer Music Technology as a field of study in its own right or components thereof within their respective music programmes.
- New technological developments are immediately integrated into Music Technology programmes.
- New career paths have been created for the "computer" musician.
- Post-graduate studies in Music Technology are possible at certain institutions.

3.4 Analysis of South African Music Technology trends

In order to place current research in context, an evaluation of the state of Music Technology in South Africa was undertaken. A number of institutions are currently or in the process of offering Music Technology curricula in South Africa. However, prior to my investigation it remained unclear to what extent, if at all, such curricula were in keeping with national education policy requirements as determined by the South African Ministry of Education. Furthermore, there currently exists no clear consensus regarding specific components (knowledge content) of Music Technology that should be offered and whether uniform standards (outcomes) should be established for institutions that offer Music Technology programmes. Clearly, there remains uncertainty regarding the status of Music Technology at post-secondary institutions in South Africa.

To address these questions and to fully understand the current status of Music Technology in South Africa, I telephonically administered a questionnaire (see Appendix A and B) to survey all post-secondary institutions offering music in South Africa. The purpose of the questionnaire was to gain insight into the current status (if any) of Music Technology at post-secondary institutions in South Africa. Questions were included to establish the number and type of institutions that offer Music Technology, enrolment, the extent to which Music Technology is offered (programmes and/or qualifications), specific components that comprise the Music Technology curriculum and whether Music Technology curricula are in line with the principles of outcomes-based education, as required by education policy. The entire population of SA post-secondary institutions (N = 17) that offer music was included.

In order to develop the questionnaire, a review of questionnaires used in similar studies was undertaken (Grijalva 1986: 115; Fábregas 1992: 128-161; Tredway 1994:110-114; Jaeschke 1996: 367-370, amongst others). Questionnaires were reviewed with regard to their relevance to the overall purpose of the study, content and structure. Several questions were adapted and used in the current questionnaire. Additionally, informal interviews were conducted with researchers who are well versed in questionnaire construction and development at the University of North Texas, Denton, Texas. Many items in the questionnaire were edited and revised, based upon suggestions from these researchers (see Personal Communication 2001).

The design of the questionnaire was based on extrapolating the required data to meet the needs of the research sub-questions.

- Firstly, given the backdrop of international trends in Music Technology, questions were structured to ascertain the nature and status of Music Technology in South Africa.
- Secondly, issues pertaining to how South African education policy requirements were addressed at the respondent's institutions were examined.
- Finally, how did institutions that purported to offer Music Technology accommodate the requirements of policy within their existing education institutional structures?

Administration of the questionnaire was conducted over the telephone with instructions and questions being read to participants and their responses documented. The questionnaire was conducted in this way in order to expedite administration, and obtain a 100% return rate. Table 3.4 indicates that of the total number of post-secondary institutions surveyed in South Africa, 82.3% were universities, 11.8% were technikons and 5.9% were colleges of education.

Table 3.4: Questionnaire results pertaining to Music Technology programmes offered in South Africa in 2001

Type of Institution	Frequency	Percentage
University	14	82.3
Technikon	2	11.8
College	1	5.9
Total	**17**	**100**
Music Technology programmes offered		
Yes	13	76.4
No	4	23.6
Total	**17**	**100**
Type of Music Technology curricula		
One semester course	4	23.5
Two semester course	2	11.7
Certificate	0	0
Diploma	0	0
Degree	1	7.7
Major in Music Technology	6	35.2
No programme in Music Technology	4	23.5
Total	**17**	**100**

Overall, 76.4% offered some form of instruction in Music Technology, while the remaining 23.6% offered no instruction. In the case of the former, Music Technology was awarded equal importance when compared to other majors such as Performance, Composition and Music Education. Just over a third (35.2%) of the number of institutions that offered Music Technology, offered a major in Music Technology, while the remaining institutions offered either a one semester course (23.5%) or a two semester course (11.7%) in Music Technology, thus confirming the notion that Music Technology may be used as an elective or "filler" course. Such courses were offered with the intention of exposing students to Music Technology rather than affording them the opportunity to major in Music Technology. Only one institution offered an undergraduate degree in Music Technology. What emerged from the results of the questionnaire was that no institutions offered either a certificate or diploma in Music Technology.

At this point in the analysis a weakness in the construction of the questionnaire emerged: no provision was made to determine what type of institution (university, technikon or college) offered specific curricula (one semester course, two semester course or major in

Music Technology). Such information would be valuable in assessing how Music Technology fitted into the curricula of the various institution types. This weakness, however, does not limit this study because it falls outside its scope.

Table 3.5 indicates that the music student population at South African institutions in 2001 ranges from twelve to 450 students for the smaller to larger institutions. The enrolment for previous years in this case is insignificant because this study examines the current state of Music Technology. An average of approximately 129 students per institution study music in South Africa. Of this average, thirty-one students (23%) are currently enrolled in Music Technology classes/courses at the various institutions that offer Music Technology curricula.

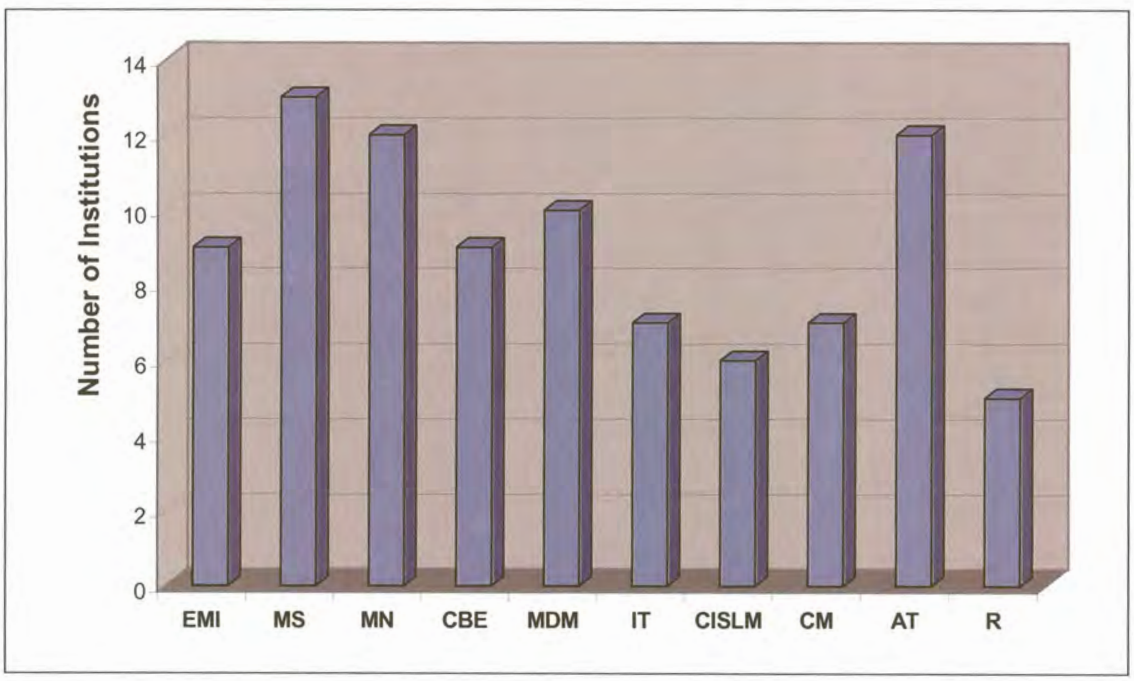
Table 3.5: Student population distribution in Music Technology studies in South Africa in 2001

South African Institutions	Minimum	Maximum	Average
Total number of students enrolled at the seventeen institutions offering Music	12	450	129
Number of years Music Technology has been offered	1	15	6.54
Number of undergraduates enrolled in Music Technology classes/courses	1	80	29
Number of graduates enrolled in Music Technology classes/courses	0	6	2
Total number of students enrolled in Music Technology classes/courses	1	86	31
Hours of instruction students receive in Music Technology per week	1	5	2.85
Total number of Music Technology components offered	3	10	7

Subsequent analysis of enrolment distribution indicates that there are distinct differences between the numbers of undergraduates and post-graduates. While the average number of undergraduates studying Music Technology is twenty-nine, there are on average only two graduates studying Music Technology per tertiary institution in South Africa. The disparity between the number of undergraduates and post-graduates studying Music Technology may be attributed amongst others (funding, availability of programmes, employment opportunities, and the like) to the enrolment profile (undergraduates and post-graduates) currently studying music.

Table 3.5 also reveals that students receive an average of approximately three hours (2.85) of instruction in Music Technology per week. The minimum amount of instruction students receive is one hour, with the maximum being five hours per week. This questionnaire also sought to obtain information on the number and types of Music Technology components offered. Results in Table 3.5 indicate that institutions offer a minimum of three and a maximum of ten components. On average, the various tertiary institutions offer seven Music Technology components. The components offered include: Electronic Musical Instruments, MIDI Sequencing, Music Notation, Computer-based Training, Internet and Telecommunications, Computers, Information Systems and Lab Management, Multimedia and Digitized Media, Computer Music, Audio Technology and Research. Figure 3.3 provides a breakdown of the number of components offered at various institutions.

Figure 3.3: Institutions offering Music Technology core components in South Africa



The Music Technology components most commonly offered included MIDI Sequencing (offered at all thirteen institutions), Music Notation and Audio Technology (offered at twelve of the thirteen institutions offering Music Technology). Multimedia and Digitized Media were offered at ten of the participating institutions while Electronic Musical Instruments and Computer-based Education were each offered at nine institutions. The Music Technology components that were least offered included: Internet and Telecommunications (seven institutions), Computer Music (seven institutions) and Computers, Information Systems and Lab Management (six institutions). Research was offered at five of the thirteen institutions that offered Music Technology.

The third and final section of the questionnaire sought to obtain information on:

- The background and training of the instructors that taught Music Technology;
- The purpose of each institution's Music Technology programme and whether their programmes were in line with OBE;
- The NQF level that programmes were pegged at; and
- The perceived need for national standards in Music Technology.

Of the seventeen institutions surveyed only thirteen offered some programme/certification in Music Technology. These thirteen institutions were used as the basis for the data extrapolated in Table 3.6. Results in Table 3.6 indicate that 53.8% of instructors had no formal training in Music Technology, but had rather obtained their knowledge through self-study. Conversely, 23.1% had obtained a degree in Music Technology and also 23.1% of the instructors had taken a short course at some point in their careers. Clearly, the majority of instructors that are currently teaching Music Technology at tertiary institutions in South Africa have no formal training in Music Technology.

Table 3.6: Analysis of questionnaire results according to national education requirements

Instructor Background and Training in Music Technology	Frequency	Percentage
Degree	3	23.1
Short course	3	23.1
Self-study	7	53.8
Total	**13**	**100**
Music Technology programme in line with OBE		
Yes	8	61.5
No	5	38.5
Total	**13**	**100**
OBE Type		
Traditional	7	53.8
Transitional	1	7.7
Transformational	0	0
No OBE	5	38.5
Total	**13**	**100**
Purpose of Music Technology programme		
Educational (for teaching purposes)	5	38.5
Industry requirement	4	30.8
Course elective	3	23.1
Other	1	7.7
Total	**13**	**100**
Need for National Standards in Music Technology		
Yes	12	92.4
No	1	7.6
Total	**13**	**100**

From the total number of institutions surveyed, the respondents indicated that more than half (61.5%) of their Music Technology programmes meet the requirements for OBE. Of those meeting OBE requirements, 53.8% of courses are structured to address traditional OBE (see Chapter 4.2.1), while 7.7% are meeting the requirements for transitional OBE (see Chapter 4.2.2). None of the institutions are addressing the requirements for transformational OBE (see Chapter 4.2.3), which is the approach adopted by the Ministry of Education.

Some 38.5% of the institutions indicated that the purpose of their Music Technology programmes was educational, intended for teacher training. Almost 30.8% of institutions indicated that their programmes were designed to meet industry requirements, while 23.1% indicated that Music Technology was included in their music curricula merely as an elective course. Finally, there was overwhelming consensus for the need for national standards in Music Technology, with 92.4% of institutions responding in the affirmative. Clearly, instructors at post-secondary institutions in South Africa support the need for national standards. Such standards will not only ensure that institutions are meeting the needs of students and industry, but that they keep pace with international trends.

It should be noted that a review of the different institutions that responded to the questionnaire also revealed that Music Technology was clearly more accessible to urban than to rural institutions. For purposes of confidentiality, names and specific locations cannot be provided. However, I was able to assess that institutions that were historically disadvantaged (see Notes to the reader, no.10) tended not to offer Music Technology. Of those institutions that did offer Music Technology, all students had access to Music Technology courses.

Supplementary data acquired at the time of conducting the telephonic questionnaire indicated the following:

- Some tertiary institutions claim to have been offering Music Technology over the past decade, albeit under different course classifications: Electro-Acoustic Music, Electronic Music, Sound Engineering, Music Composition.
- Most of these "Music Technology" courses have been based on or been largely influenced by international models.
- There is some national consensus with regard to the core components and competencies that make up Music Technology as an emerging field of study in South Africa when mapped against the core components identified internationally (see Chapter 3.3.1 and 3.6).
- There is growing interest among most Music Departments to have formal courses/qualifications in Music Technology.
- The career paths available to Music Technologists in South Africa are limited due to the fact that this is a new field of study.
- Music positions overall are being marginalized due to economic pressure. This can be deduced from the recent closure of Music Departments (University of Durban-Westville, University of Western Cape), the State Theatre (Pretoria), Orchestras (National Symphony Orchestra, NAPOP) and the abandonment of Music as a specialist subject at many schools.
- Although Music Technology is the most recent new qualification offered in some post-secondary music institutions, current educational policies have not been implemented, as international qualifications and models continue to form the basis for these programmes.

The South African, as well as the international, trends examined indicate that the field of study, Music Technology, is growing and has become an integral part of the curricula of most South African post-secondary Music Departments. The questionnaire (Appendix A) therefore highlights the need for this research. The inclusion of Music Technology as a field of study within existing music curricula is becoming imperative in order to keep abreast of industry expectations and international trends.

3.5 Identification of South African needs in Music Technology

An analysis of the needs of the South African music industry, as articulated by the Standards Generating Body for Music Industry, coupled with the results that emerge from the questionnaire (see Chapter 3.4), revealed the urgent need for the following:

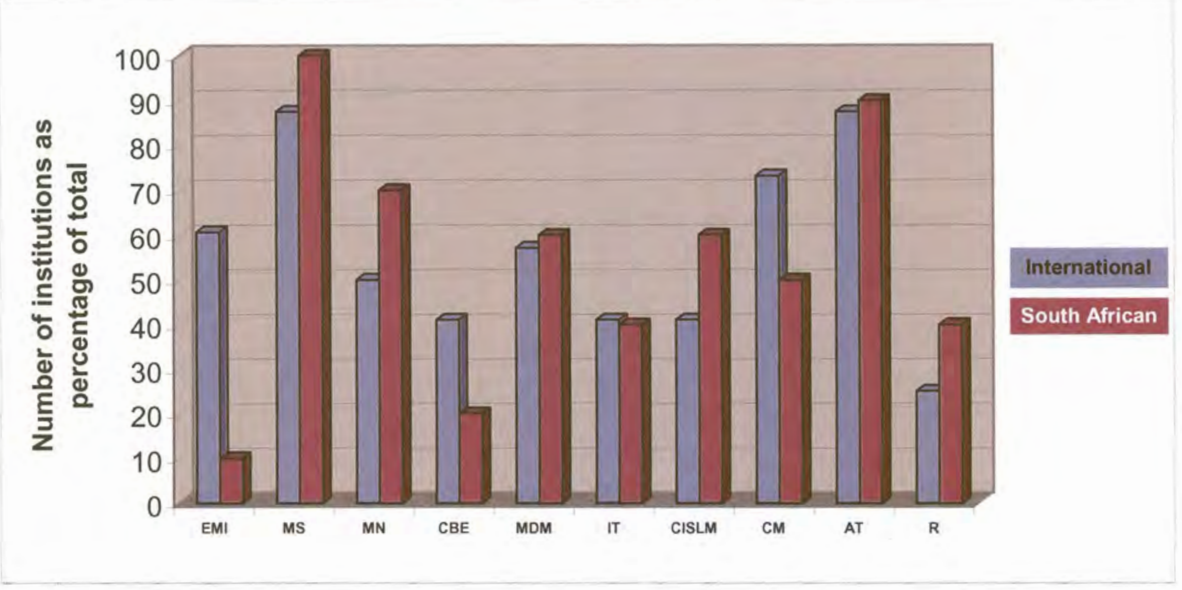
- A qualification to provide access for the majority of music students who require to express themselves creatively through Music Technology;
- National standards in Music Technology;
- A qualification in Music Technology that identifies with the needs of the South African music industry, supported by the education sector;
- A clearly defined qualification that is flexible in its content in order to reflect and accommodate the changing technological environment;
- A means of upward educational mobility toward higher qualifications in Music Technology, the field of study;
- Identification with career opportunities available to learners with such a qualification;
- Identification of components that contribute toward the development of career opportunities;
- Clearly defined sets of outcomes that form the basis of a qualification; and
- A qualification that addresses the transformational needs of South Africa, while at the same time keeping abreast of international trends.

The issues addressed in the analysis in Chapter 3.4 and earlier in this section identify the international (see Chapter 3.3) and national trends, while at the same time examining the needs of the music industry in South Africa. Since the transformation of South African education towards meeting the requirements of OBE is seen as an ideal, my proposed qualification presented in Chapter 5.3.1 will attempt to address these requirements.

3.6 Comparison of international and South African Music Technology core component trends

Figure 3.4 illustrates a comparison between the international and South African Music Technology component trends.

Figure 3.4: Comparison of International and South African core component trends



The South African institutions represent 18% of the total number of institutions analysed. In order to ascertain differences/similarities between the international and South African institutions, they were mapped against each other. The results show that the Music Technology component distribution that reveals a relationship is situated in the areas of MIDI Sequencing, Multimedia and Digitized Media, Internet and Telecommunications, and Audio Technology. These areas indicate between 2% to 12% similarity. The areas specifying approximately 20% difference are Music Notation, Computer-based Education, Computers, Information Systems and Lab Management, Computer Music, and Research. The greatest difference was reflected in the Electronic Musical Instruments component of greater than 50%.

Six of the ten components of Music Technology in South Africa show a difference of 20% or more in relation to international trends. This difference could be accepted as normal, since international institutions in most cases do not have to conform to a central education controlling body as is the case in South Africa. Besides, there is no common consensus as to what constitutes Music Technology. Since the South African trend mirrors the international one, the formalizing of these components within Music Technology curricula in South Africa would be beneficial to prospective institutions opting for learning programmes in Music Technology.

3.7 Summary

The review of literature outside of music suggests that technology is a fast developing field internationally. Most curricula around the world (in technologically more developed countries) are designed to meet specific cultural needs of designated societies. With the design of these curricula, certain concepts relating to curriculum, qualification design and Music Technology recur. Two such concepts that impact on this study, highlighted thus far, concern technology programmes and education policy and the interdisciplinary nature of technology. These two concepts will be explored later (Chapter 5.1) in this study.

The concepts identified above also manifest themselves in studies within music. The studies reviewed suggest that there is an increased usage of music technology internationally towards the latter part of the 20th century. Therefore, fields of study like Music Technology need to be integrated within the broad framework of curriculum design. With regard to the nature of Music Technology, it is evident that this field of study is located within the broader study of music, resulting in a shift from Mode 1 (disciplinary knowledge) to Mode 2 (interdisciplinary knowledge).

The use of music technology within the studies reviewed in this chapter suggests that the computer is primarily utilized as a tool in the music making process. It is this notion that locates several Music Technology programmes in the USA in the domain of music processing, according to the MENC standards for Music Technology (Rudolph *et al* 1997: 43), a significant domain of Music Technology.

Furthermore, two additional concepts identified in this chapter suggest Music Technology as a tool that can be used to enhance and broaden the base of the discipline Music; and as an equal partner (enabler) in the music creation process, through components such as Computer Music and Electronic Musical Instruments. However, within the South African Music Technology context, as can be deduced from Chapter 3.5, the second concept of Music Technology as an equal partner in the music creation process is marginalized, if not absent.

There is a correlation between international trends with the ten components that constitute the field of study and the interdisciplinary nature of Music Technology. It is important to note the close relationship between Music Technology, music industry and the job market. The job market in particular reflects the emergence of new career paths for the Music Technologist. Therefore the integration of theory and practice is crucial in the designing of a qualification in Music Technology.

Although South African educational institutions follow international trends, these new career paths have yet to manifest themselves locally. The delay in this development could be attributed to several factors, some of which include:

- Most institutions are still conforming to traditional educational practices (traditional and transitional OBE) and have yet to implement transformational OBE;
- Aligned to transformational OBE, are the issues related to equity, access and redress for a vast majority of historically disadvantaged learners;
- Vertical and horizontal academic mobility between institutions; and
- The need for Music Technology to be recognized as a formal field of study with clearly defined competencies within the mainstream of the discipline Music.

There is, therefore, a need to transform the current educational and music educational structures to generate national standards in Music Technology. This transformation needs to take cognisance of systemic and curricula implications suggested by national policy, which will be discussed in the next chapter.