AN INVESTIGATION OF GROUPS COMPOSING MUSIC IN A COMPUTER LEARNING CULTURE USING MICRO-PROCESSOR BASED MIDI SYSTEMS.

by

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ABSTRACT

Composing music appears to have been marginalised in many secondary school music programmes. Music research on composition and student learning fares no better. The advent of information processing technologies and knowledge based systems offer powerful compositional tools with the potential for transforming the face of music education. However, if the context for this change is overlooked these tools may be wasted.

By themselves micro-processor based MIDI systems can do nothing. When viewed as part of a learning culture, computers, teachers and students interact together to enhance student learning. Cognitive gains may depend on the type, extent, and quality of interaction taking place within the computer learning culture which surrounds the use of educational software tools. The role of the teacher is to create socially interactive and reflective learning environments.

This study explores how groups compose music with computers in such an environment. It aims to observe what happens - or can be made to happen - under natural conditions where powerful roles are played by the cultural, social, and institutional contexts. The emotional aspects of student learning, attribution theory and metacognition are discussed in more depth.

It is not enough, however, to simply use composition tools in the classroom. Effective thinking and learning should be accompanied by direct teaching of efficient strategies and problem solving techniques. Recently several researchers have drawn attention to the importance of social factors in the development of thinking skills. The following research follows this line of enquiry.

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INTRODUCTION

The following study examines how students learn to compose music with computers and the conditions under which this learning takes place. Factors that contribute to an understanding of the learning process are explored. This focus on a process oriented curriculum considers the interaction between students, teacher and computer, rather than one particular factor.

Recent Heylen research shows that although the basic skills of reading, writing and arithmetic are regarded by many New Zealanders as important, so to are other skills such as the ability to communicate well, work with others, learn new skills quickly and be self-disciplined. These social skills are rated as highly and in some cases more highly than skills gained in traditional subject areas (QA News, 1992).

In keeping with the above research it is suggested that significant learning gains may be made through direct teaching of social skills. The reason for this is that awareness of a student's own thinking and self-regulatory activities often develops through social interactions with other learners (Vygotsky, 1978). Promoting social skills through interactive groupwork and encouraging thinking skills through problem solving strategies provides the research context. Intervention within this context emphasizes strategy use from the lowest level of strategy acquisition (teacher-imposed) to the highest level of acquisition (student directed).

The multi-faceted nature of the learning environments surrounding computer tools highlights the relevance of ethnographic methodologies and techniques for analysing affective and cognitive processes. The teacher-researcher like the anthropologist seeks to understand which cultural materials are relevant to cognitive development.

In portraying the learning culture of which the computer is a part, the researcher will want to know how computers assist the process of cognitive development. The use of holistic, open-ended methods characteristic of ethnography, allows the researcher to study the computer as a cultural element - "something that can be powerful when it is integrated into a culture but is simply isolated technical knowledge when it is not" (Papert, 1987 p.24). It is suggested that how students use the available technology to support their learning is critical to understanding the learning process.

A variety of information gathering measures are employed ranging from group interviews to document analysis. The types of interaction and approaches to problem solving that emerge from these measures may give clues for more effective learning. Two overlapping areas of concern are considered. These focus on: 1) thinking skills and learning strategies, and 2) social interaction and peer learning. Several related process oriented questions are examined, including:

What are the characteristics of a computer learning culture?

how do students, teacher, and computer interact in such a culture?
how significant is student perception of control to learning?
how are the students initiated into "adult" activities?
how does strategy use aid learning in this culture?
which students use more advanced thinking and metacognitions? Why?

In what ways does a computer culture help students learn to compose music?

how does the way the groups are structured influence student interaction and learning?
how influential are factors like innate musical ability, student interest, peer interaction, previous computer or musical experience, on students learning to compose music?

do micro-processor based MIDI systems help bridge a musical 'knowledge gap' for students without a background in music theory?

which students :
monitor, plan and self-regulate during problem solving activities?
interact more with peers and exchange more information?
explore more and show greater creativity in compositions?
engage in more self-evaluation, or editing of compositions?

how do students compose music?
aurally; with conventional notation (on screen); or with pencil and paper?
do these techniques require skills which are the same or different?

How do other factors influence learning ?

how does: culture, background, physical setting, and the wider environment?

A number of music teachers have expressed caution against accepting computers. "Many have not begun to take advantage of the computer as teachers in other subject areas" (Steinhaus, 1987 [b] p.23). In light of this the potential of micro-processor based electronic equipment for enhancing learning is discussed and the place of music composition software in the classroom is evaluated.

A review of some recent process orientated composition software is provided in an attempt to map this largely uncharted territory. It is apparent from this review that there are few studies relating music composition with computers to student learning. This research attempts to address this imbalance.

CHAPTER ONE
COMPUTERS AND THE LEARNING PROCESS

Underlying the use of computers in education have been different views about thinking and learning. Computers were first viewed as instructional delivery systems, capable of delivering programmed instructional material with more flexibility than the teaching machines of the 1950's. Thus, the emphasis was learning from computers. This approach continues today as one aspect of computer based education.

A second view, the computer as a learning tool or "object to think with" (Papert, 1980), has been the subject of more recent discussion. This learning with computers approach regards word processors, data bases, music sequencers and educational programming as intellectual extensions of the student, with the result that learning effectiveness is increased. Upitis (1983[a]), notes that:

> ...computers are being regarded less as a vehicle for delivering programmed instruction and more as a means for allowing children to actively manipulate variables and solve problems (p.41)

Seymour Papert's (1987) position paper, 'Computer Criticism vs. Technocentric Thinking' highlights this distinction between 'learning from' and 'learning with' computers. Most educational computing research to date has made a similar distinction. For example, research surrounding the language LOGO, has been concerned with the process of learning, while research into Computer Assisted Instruction (CAI) was product orientated. Research with a product orientation tends to consider the computer in some way "intelligent" - and able to act directly on the learner to produce complex cognitive skills.

Conversely, research about learning processes tend to consider a range of factors including the computer. While these two approaches to learning may be regarded as complementary, the 'learning systems' approach (Ryba, 1984), with

its focus on the processes of learning, may offer special insight into how groups of students learn to compose music with computers and the conditions under which such learning takes place. In particular, this approach may help indicate how thinking skills and learning strategies are enhanced.

What are thinking skills and learning strategies?

Thinking is a process which involves the collection, manipulation, and use of information to solve problems (Ryba, 1990). This definition covers a wide range of thinking skills. A more precise set of skills which are directly observable and relate to important internal mediating processes are listed below (Table 1). They form the basis for the development of cognitive (learning) strategies.

A. EXPLORATION :
   # observing,
   # describing,
   # predicting and explaining,
   # comparing and contrasting.

B. ANALYSIS and PLANNING :
   # identifying the problem,
   # analysing the problem,
   # developing options for solving the problem
   # decision making

C. QUESTIONING :
   # knowing how and when to ask questions
   # asking different kinds of questions

D. SELF-MONITORING :
   # checking and regulating activities
   # evaluating and revising activities.

Table 1: Thinking Skills

[From Ryba & Anderson, 1990. Learning With Computers: Effective Teaching Strategies].

Seigler (1983) has argued that the information-processing approach is the leading strategy for studying cognitive development. The emphasis is on the processing activities that underly thinking (e.g., remembering, problem solving). The ability of the student to understand what is required, to understand their own capabilities, to plan strategies that will allow them to reach the goal, and to monitor and coordinate these activities are thought to be critical determinants of problem-solving success.

A learning systems approach

When computers are viewed as part of a learning system the complex cognitive, interactive and problem-solving nature of human learning may be explored. Learning itself may be fundamentally redefined. Traditionally the basic self-management processes for controlling thinking and learning processes have been under the teacher's control, not the student's (Pea, 1987). Research into social comparison, motivational and attribution processes (Weiner, 1972; Ryba, & Chapman, 1983; Reeve, & Brown, 1985) suggests that when students perceive that they are "in charge" or in control significant learning gains may occur (Paris & Winograd, 1990).

Accompanying moves to increase student control, attention has been given to the social learning context of computers for developing interpersonal skills and cognitive self-management (Male, 1988; Johnson, 1984; Ryba, 1989 [a]). The highly interactive nature of the computer may be a springboard for social interaction as well as providing a medium for teachers to guide students to take control of their learning. In an environment that encourages learners to gradually take over the self-management role from teachers, social and emotional development is enhanced (Ryba, 1991 [a]) and intellectual growth is promoted (Clements and Nastasi, 1988).

Transferring control for learning from teachers to students may mean explicit teaching of both affective (social, emotional) and cognitive (intellectual, problem

solving) skills. The question of how to develop affective and cognitive skills in a computer environment under student control may be one of the most promising yet demanding challenges facing educators today. One way the computer may be important in this endeavour is by providing the tools and structure for learning, thereby allowing the teacher to engage in interactive, adaptive and dynamic interactions with learners (Goldman, & Pellegrino, 1987).

A strategies approach (described in 'Towards a Synthesis') is one way to effectively promote social interaction and cognitive self-management in the computer environment. This approach is illustrated in a recent LOGO programming project (i.e. drawing pictures and geometric designs with LOGO commands) which emphasised direct teaching of such specific skills as asking questions, sharing information, and helping others to solve problems (Ryba, Bishop & Bishop, 1989). Students were encouraged to talk aloud about their thinking on the basis that such overt verbalisations would help them to mediate their task performance. The overall aim was to create a socially interactive and reflective learning environment in which students were free to consult and to make as many mistakes as necessary to complete their projects.

These sharing and helping activities form the basis for what has been termed a 'computer learning culture' (Ryba & Anderson, 1990). Such learning cultures may be quite different from each other, emerging in their own way through the interaction of the students and the way they use the computer. The assumption made is that students encounter computers in a particular way, in a particular relationship to other people, teachers, peers and friends. Computers, students, teachers - each by themselves can achieve little. Learning relies on the interaction between these elements of the learning culture.

A learning culture is not something that can be defined in textbook terms. It has as much to do with social engagement and sensitivity toward others as it has to do with cognitive development and curriculum. The outcomes are "soft" and personal rather than "hard" and intellectual (Ryba, 1990).

The question of how students learn to compose music with computers is most likely to be answered by focusing attention on the learning culture. The design of learning cultures requires a high degree of special teacher skills in using the computer and in socially interacting with students as they learn to use the computer. Encouraging students to reflect on their thinking can be done by encouraging, helping and generally supporting students as they get on with their work.

To do this job well, teachers need skills in observing, asking questions and facilitating interaction based on a clear understanding of the software and hardware (Au, Horton and Ryba, 1987) (Appendix One : Teacher Intervention). The teacher as a Guide, for example, may ask open ended, exploratory questions such as:

* " What are you doing?"
* " What were you trying to do?"
* " Is that what you wanted to do?"
* " What do you think you will do next?"

Teacher intervention was found to be a key factor by Upitis (1982) when using ALF (i.e., a music editor; - see also Turrietta, 1983) for teaching Music Composition. Teacher characteristics, such as teaching skills and musical background, were found to be of critical importance for the success or failure of this approach to music composition.

The discussion so far has considered interaction between students, teacher and student and student and computer is an important component of the classroom learning culture. It is also necessary to consider the nature of this interaction for while "most educators agree that the microcomputer setting has the potential for promoting interaction among students, ...there has been little systematic investigation of the kinds of interaction that occur when students work in groups with the microcomputer" (Webb, 1984 p.1077).

A second related concern is that the above discussion has only been "social" in terms of interactions between individuals. Salomon (1986 p.17) points to the need to explore the wider social-political context - relationships between the particular setting, or micro-structure, and the larger societal context, or macro-structure (Krueger, 1987).

An approach is needed which can adequately take all these factors into account. If the school setting is a rich learning environment, composed of numerous interrelated and mutually meaning-providing elements then numerous cognitive, social, and affective outcomes may emerge. The problem of capturing the multivariate rich classroom environments that the effective use of computers requires and brings about may be answered by a more indepth analysis of theoretical and historical trends. Several perspectives in the development of computer are now considered.

These perspectives are not separate, mutually exclusive categories, but they do reflect an evolution of thought. Each perspective has a theoretical foundation that stresses some important elements of teaching and learning with computers. The question of empowering students to be more effective and self-directed learners may best be addressed by describing each perspective as a separate area. In this way historical changes may be clearly seen as the perspectives evolve over time. Where possible the perspectives have been considered in terms of their parallel development in music education.

1.1 The Instructional Technology Perspective

When computers were first used in education they were seen by many as a way of teaching without teachers. Most early music research used CAI approaches for ear-training, sightreading, and rhythm perception. Training programs of this nature met with some success in developing automaticity in basic skills. Allvin, for example, developed an instructional approach to sight-singing in 1967. In response to visual stimuli, the student sang what he or she judged to be the appropriate notes. After receiving an evaluation, the student either repeated the task, completed a similar one, or moved ahead in the sequence (Allvin, 1971).

During the 1970's Placek developed a similar GUIDO system on a large PLATO mainframe (Arenson & Hofstetter, 1983). The theoretical rational for such research is primarily linked to the main components of learning theory - individualisation, behaviourism, and educational technology (Ryba, 1991 [a]).

Computer and music research of the early 1980's began to swing away from the previous focus on instruction, but not convincingly so. Of eighty-four items identified in a search of the ERIC database using the descriptors "Music Education, Composition; and CAI" (Walley, 1987), most advocated an instructional approach to learning. The underlying question was "What is THE effect of THE computer on ...". Such experiments, which purport to measure computer effects, tend to cast the student into a passive role.

Research questions like these reflect the view that computers and various kinds of educational software are somehow capable of directly affecting thinking and learning. Little attention is given to the physical, social and educational contexts (Moore, 1987). However, the idea that most school activity exists in a culture of its own is central to understanding many of the difficulties of learning in school (Pea, 1990).

A swing in thinking away from computer effects and onto the social practices of education occurred as researchers began to consider the influence of people and culture. The underlying rationale considers that student's ways of learning and thinking might change in the presence of computers. But if these changes are to be fully understood, or influenced, attention should be focused, not on the computer, but on the influence of the surrounding culture.

1.2 Emerging Cultural and Cognitive Perspectives

Interest in the effects of computers was shifted dramatically with Papert's research (1980). Papert noted how the kind of cultural environment and computer activities created around students aided their thinking. The constructivist view, that student's are the active builders of their own intellectual structures, is fundamental to an understanding of this process (Piaget, 1971). Within this context, the curriculum is not a structured set of skills to be taught. It is an environment where learners, both skilled and novice, may interact, express and evaluate their thinking.

This view is founded on the belief that students learn in their own time through their own experiences (see also Serafine, 1985 for an example of this approach in music). Upitis, (1983 [b]) argues that being a musician in this environment implies that one ought to do music as opposed to just knowing about music. The learning process is active, self directed and empowers the learner with high level thinking skills. This active participation encourages direct contact with the expressive character of the music (Reimer, 1989), enabling students "to experiment with sound in meaningful ways, to the end that when pupils leave school they are musically self-sufficient" (Slind, 1971 p.5).

Students need to be provided with music-producing materials which they can handle and manipulate in order to find, for themselves, order in the musical domain. They need "the raw musical materials with which to make Piagetian manipulations of musical elements, in the same way that such a learning environment appears to catalyze and cement discoveries made by children about their physical world" (Upitis, 1983 [b] p.42)

A useful distinction by Brown (1989) which builds on the theme of integrating 'doing' and 'knowing' is that students need to engage in activity which is authentic. It may not be enough to just 'do' an activity. Effective learning takes place when students use the "domains conceptual tools" (p.34) in an active,

social way similar to that undertaken while serving the apprenticeship for a craft. It provides students with the opportunity to enter the culture of the craft. Ideas are exchanged and modified and belief systems developed and appropriated through conversations and narratives. A good craftperson does not only have a wide assortment of cognitive tools but uses them selectively to accomplish particular purposes.

In music composition this may involve challenging students to do deeper processing to gain a better understanding. For example, students may apply complex perceptual and cognitive strategies (e.g. the ability to combine phrases, or, analysing harmonic progression) to the processing, understanding and appreciation of musical sequences (Reimer, 1989). Students could also use a musical element such as rhythm. Initially this could be examined by considering the interrelationship between the 'pulse' and the 'pattern' of the notes. Later, however, consideration could be given to the influence of musical style on the rhythm of different musical periods (e.g., the unflagging rhythmic drive characteristic of much Baroque music.

1.3 The Social Dialogical & Metacognitive Perspectives.

A common theme of researchers from quite different nationalities has been that individual thought processes may have their genesis in social interactions (Bruner, 1985; Piaget, 1971; Vygotsky, 1978). A key concept for Vygotsky is the zone of proximal development (ZPD). This zone includes those tasks that a student couldn't solve alone, but could solve with some help. The person who collaborates with the student provides a supportive structure during the task, and engages the student in a process of developing meaning about the task.

As students become aware of their thinking and aware of their ability to gain and maintain control over the learning process they are engaging in a process called metacognition. Brown and Deloache (1983) suggest that basic metacognitive skills include prediction of consequences, and checking the outcome of an action, monitoring an ongoing activity, reality testing and a variety of behaviours for controlling and coordinating deliberate attempts to learn or solve problems. Research evidence also suggests that metacognitive skills underlie successful performance in everyday activities involving memory, reading comprehension, study strategies, oral communication and complex decision-making (Paris and Lindaer, 1982). If it is possible to foster the development of metacognitive skills students can enhance their learning by becoming aware of, and exercising control over their own learning.

Such awareness can lead to flexibility and confident problem solving as well as feelings of self-efficacy and pride. The transfer of responsibility (i.e., control) for monitoring learning from teachers to students can promote positive self-perceptions, affect, and motivation (i.e., both 'skill and will') among students. The origins of self-conscious regulation lie in adult-child interaction suggests Wertsch (1985). Teachers can directly promote this awareness in a variety of ways including informing students about effective problem solving strategies and discussing cognitive and motivational characteristics of thinking.

How teachers structure student-student interaction patterns has a great deal of influence on how the students learn, their attitudes towards school and subject areas, their attitudes towards each other, their self-esteem, and their attitudes toward the computer and computer related careers (Johnson and Johnson, 1986). The teacher can provide clear explanations and modelling of metacognitive strategies. Through the process of cognitive coaching explicit information, goals, and procedures for helping students to think about thinking are communicated in a meaningful context. In this way the teacher provides the learner with just enough support and guidance to achieve a goal that would be impossible without assistance.

The teachers involvement gives students the cognitive "scaffolding" which acts as a "..vicarious form of consciousness until such time as the learner is able to master his own action through his own consciousness and control" (Bruner, 1985,p.24). The role of dialogue is prominent in this process of predicting, questioning, clarifying, and summarizing.

If learning is a process of enculturation that is supported in part through social interaction and the circulation of narrative, groups of practitioners are particularly important, for it is only within groups that social interaction and conversation can take place (Brown, 1989). In a school setting it is possible through discourse analysis to study groups engaged in particular kinds of metacognitive activity (Anderson, 1988). The teacher needs to be well-schooled in all facets of metacognitive learning so that students may be empowered to make effective decisions about what tasks to pursue, how hard to try, when to seek help, and how to overcome obstacles.

1.4 Towards a Synthesis - the Ecological Perspective.

In keeping with the theme of empowering students to become more effective and self-directed learners, active teaching of both social and cognitive interactions is proposed under the broad heading of an ecological perspective (Ryba, 1989 [a]). This perspective incorporates key ideas from several other perspectives discussed previously. Such an approach is "illuminative" in the sense that it provides an indepth analysis of a particular "computer culture."

This includes analysis of:

(1) the teaching methods;
(2) physical environment;
(3) learning atmosphere;
(4) quantitative data;
(5) qualitative data focusing on aspects of metacognitive awareness and affective aspects.

The work of Erikson (1982) was influential in providing the main tenets in the ecological perspective. Erikson advocates ethnographic inquiry into "taught" cognitive learning. From an anthropological perspective he suggests that it is the pedagogical encounter itself - the adaptive transaction between the individual and the immediate learning environment - that should occupy the centre of analytic attention.

He suggests that research needs to take account of the reflexive calibration between individual teachers and learners as they construct learning environments for each other. Thus, individual cognitive functioning needs to be analysed together with the social, political, and cultural factors in which the learning environment is embedded. Attaining this goal requires the development of models of the learning process that embody social and cognitive theory, the curriculum, and the educational environment.

Ryba (1989 [a]), in adapting Erikson's key ideas has developed a model which demonstrates the relationships between social and cognitive interactions in the classroom computer environment (Appendix Two). The scheme graphically illustrates the reflexive nature of relationships between individuals, the immediate environment and the wider social context.

Recent research has demonstrated how an ecological perspective can be applied in different research contexts. Havel and Papert, (1990), undertook an indepth study of students engaged in software design with Logo Writer. Clements (1988) demonstrated, similarly, how an ecological perspective can be applied in a LOGO programming context. The computer environment is useful for presenting cognitive and metacognitive problems that must be negotiated, forcing social exchange and, therefore centrational conflict and resolution. It is through this social coordination of knowledge that students progressively restructure their cognition.

The ecological perspective provides a useful overview in the learning with computers thesis. A more specific means of intervention which fits well alongside it, is the strategies approach. Learning strategies are thoughts and behaviours which constitute organised plans of action designed to achieve a goal (Weinstein, 1988). Students can use strategic thinking to help them organise their ideas and work systematically. It allows them to gain a more accurate perception of themselves and to describe their ideas and feelings, explaining their point of view and supporting what they have done (Ryba, 1991 [a]). The aim of a strategies approach is to directly teach cognitive and affective skills. This can be done in any subject by teaching process as well as content. Computers are ideally suited to the strategies approach because they provide a manageable environment in which the focus can be placed on process (van Deusen & Donham, 1987).

The task before teachers and researchers is to attempt to derive the maximum benefit for students from these approaches. Educational intervention means

changing the culture, planting new constructive elements in it and eliminating undesirable elements. It means supporting students as they build their own intellectual structures with materials drawn from the surrounding culture. Failure to establish such an environment may mean that the computer is ineffective in terms of empowering students to become more effective and self-directed learners.

CHAPTER TWO
COMPUTERS AS TOOLS FOR INTELLECTUAL EXPLORATION

Computers, unlike more traditional media, are many things at once, depending not so much on the machine but on the software used and the activities carried out with it. From an educational viewpoint, computers are tutors and creative tools, memory repositories and number crunchers, electronic workbooks and much more (Robert, 1980). It is impossible to speak of 'the computer' in any general sense, except on the most general socio-historical level. There is no such thing as "LOGO-in-general" or "programming-in-general". It is the way the computer fits into the environment and how it is developed that will ultimately determine the effect it has on students' cognitive development.

Of the many ways that computers can be used and the many functions they can serve, "the one most promising for education is that of making, doing and creating" (Salomon, G; Perkins, D; Globerson, T. 1991 p.523). Here, the computer is not just another, perhaps more efficient teacher or drill master, but a symbolic tool that affords the (guided or unguided) opportunity to program imaginary monsters, design new ecologies and galaxies, consult far away peers and encyclopedias, and compose music. In the area of experimental music, "computer-assisted composition has historically been an intellectual exploration, not a productivity tool. The idea is not to make composing easier, but to go further, or in different directions, with the same effort" (Keyboard, 1990 p.56; see also Marshall, 1988).

The computer is a tool that allows the user not only to invent ideas and test them in the real world, but also to make them happen on a symbolic level and be shared with others. Computer tools are, or at least can become, 'intellectual partners' that profoundly extend the reach of a limited cognitive capacity. They hold the promise of "supporting intellectual performance and enriching individuals' minds" (Salomon, et al 1991, p.2).

Such a tool may enable students to "...manipulate relationships among elements in symbol systems in ways that are orders of magnitude both faster and qualitatively different than what was possible before" (Hawkins, Mawby & Ghitman, 1987, p.276). The student creating a model of an Iraqui invasion of Kuwait, or responding to jazz harmonic progressions by means of a MIDI-enabled computer (i.e., acronym for Musical Instrument Digital Interface - see later this chapter), becomes involved in an entirely different kind of learning, engaging qualitatively higher order thinking skills than the one doing it without that tool. In essence, the computer is not a new way of doing old things, it represents a new way of doing new things (Ryba, 1984).

According to several researchers, MIDI-enabled systems are symbolic computer tools that help take away the physical component of music making in a way that has not been possible before (Slind, 1971; Strange, 1987; Bateman, 1987). Mayer (1975) comments that the student does not expect to perform "a regimented series of mental and physical calisthetics...in order to make music" (p.58). In contrast, computer-enabled MIDI systems allow students to accomplish all the essentials of genuine composition: to produce and retain a musical idea by recording it from authentic sound sources, to review it and make whatever refinements they choose, to extend it, enrich it, and develop it while keeping it available for further refinements. When it is finished, it exists immediately and permanently for others to experience at the push of a button (Reimer, 1989).

At each stage in this process the learner is in control and can receive an immediate, accurate replay. The process is open-ended and nonjudgemental as the computer does not suggest which direction the composition should take (Upitis, 1983 [b]). This aspect of learning has been considered particularly important because of the temporal nature of music. Students can test predictions and ideas almost as they make them. If students are unable to reproduce the sounds they imagine, their ideas and predictions may well be lost. The user must also make choices regarding the content and form of what is produced - the computer does not suggest what composition should be created.

While student's will operate within some constraints, these constraints may serve to heighten the nature of the composing process (Gallagher, 1987). For example, inaccurate note grouping or time signature during playback may lead the student composer to discuss, evaluate, and refine the original attempt (Appendix Four provides two detailed examples of this process).

In a recent support paper to the new Music Syllabus, this use of computer tools for composition is encouraged:

> The new syllabus in music education stresses the areas of creation, re-creation and appreciation. Computer technology reinforces this by opening up the possibility of an exciting and potentially limitless soundscape not constrained by the need to acquire some of the traditional techniques to express and re-create musical thoughts (Department of Education, 1989).

This reference to an 'exciting and potentially limitless soundscape' alludes to the rapid development of electronic tools in music which has occurred over the last five years.

2.1 The Development of Electronic Tools in Music

The face of music education is being changed by the widespread use of digital processing equipment. "In the past few years, desktop computers have radically changed the working habits of thousands of composers" suggests Scholz. He adds "Sequencing and notation software are displacing or augmenting pencil and music paper much as word processors have pushed aside the typewriters on many writers' desks" (Keyboard, 1990 p.55).

As computers are advanced digital microprocessors they are well suited to controlling other microprocessor based devices responsible for generating such sounds. Music composition software frequently forms the heart of an entire

microprocessor based music system which includes sound modules, drum machines, samplers, sequencers and a synthesizer (see Appendix Five).

Digital sound quality

Digital technology and micro-processor based MIDI systems are producing sounds that have never been heard before. Probably the most striking thing about MIDI digital technology for the listener is the clarity, depth and breadth of the sound. "The audio quality can be superb, to CD standards or better, and the convenience for trial-and-error experimentation non-destructive to the original versions is no longer the stuff of dreams, but a matter of routine" (Jordahl, 1988 p.79).

Information about the original sound sample is carried by binary code resulting in no loss of sound or addition of noise. The original piece of music may have its speed altered, be quantized (i.e. rhythmically corrected), be transposed into different keys, or manipulated and processed ad infinitum, but the final result on playback will sound as crisp and authentic as the original.

The MIDI standard

Prior to 1983 computers and synthesizers were unable to "speak" to each other. Lack of an industry standard for the microprocessors that control such music systems led developers to producing their own hardware and software that were incompatible with other manufacturers' equipment. As a result several major electronic instrument manufacturers developed MIDI (Massey, 1988).

MIDI is a hardware/software standard for interconnecting micro-processor-based musical instruments and controllers. MIDI enables communication in binary code through two five-pin connectors and cables. One cable receives the incoming signal at MIDI IN, while the other cable simultaneously sends the signal at MIDI OUT. An interactive music system is thereby created.

Advantages of MIDI

One advantage of 'the MIDI connection' has been to turn musical instruments into computer peripherals. Thus, the computer as master controller can manipulate musical input from the synthesizer keyboard in a variety of ways. This is usually difficult to do on a synthesizer with its comparatively limited memory and graphic display area.

In a similar manner, the MIDI connection enables playing and recording from the synthesizer rather than the computer console - a far more natural way for students to interact musically. The range and quality of sounds available through a synthesizer are frequently superior to those generated by a computer's internal speakers or add-on sound boards.

Perhaps the biggest advantage, is that MIDI is making it possible for a much larger group of people to make music. This is attested to by the recent widespread growth of home studios using MIDI equipment. Increasingly in music, and composition in particular, the boundaries between commercial and educational, professional and amateur, are becoming blurred. More software is being written by educationalists and the price of sophisticated professional equipment has plummeted to the point where any moderately well-off composer can have a home studio.

Limitations of MIDI

MIDI was developed by several synthesizer manufacturers for a commercial market. Economic considerations included hardware extensibility, protection from obselecence, and interfacing with computers. MIDI was designed as an event-based network using a serial communications protocol, and not a sample-based one. It communicates human gestural control information. In

terms of absolute control and precision of these human gestures, the full MIDI specification as it is implemented may be considered inadequate. However, a detailed discussion of bandwidth limitations, performance capture, synthesis control, or even control transmission problems is beyond the scope of this study. Rather a focus on student learning with computers may reveal more significant educational outcomes. "Innovation will require not only educational reform but a reformation of our concepts of learning, working and management" (Brown and Purcell, 1988 p.4),

While teachers should guard against accepting these machines as compositional or performance cure-alls, they need to develop strategies that allow students' control of the medium. The challenge for educators may be to promote the view that microprocessor based computer tools do offer powerful composition possibilities but if the context for human change is ignored these possibilities may not be fully realised. From an educational perspective comes the call to encourage a composition programme which is much wider than the computers finite capabilities. This should include a variety of composition orientated resources and strategies other than the computer.

Implementation

MIDI has probably been implemented on over 80 percent of the music composition packages currently available (Steinhaus, 1987 [a]). Acceptance of the MIDI standard has become evident by the release of software, electronic keyboards, digital drum machines, sequencers and other instruments that are MIDI compatible.

Implications for learning.

Improved performance while an intellectual tool is available may occur because computer programs duplicate already existing functions - allowing faster access of information, less tedious editing and computing - thus carrying out such functions faster and easier. They have what Perkins (1985) called, only "first order fingertip effects" (p.12). More profound and direct "second order fingertip effects" can be expected when computers do not just duplicate existing functions but qualitatively alter them, affecting what is done, how it is done, and when it is done.

Similarly Salomon (1990), suggests the effect on performance during partnership (see also Brown, 1989, on "situated cognitions") may be different from later effects - or, "decontextualized cognitions". To illustrate, do students composing with semi-intelligent computers engage planning and diagnosing processes they could not otherwise engage (are there effects with the tool)? Do the students subsequently show better planning or analysis of a musical passage in a later listening activity (effects of it)?

Perkins suggests that a closer look at how students process information may give grounds for concern. For example, research on recognition and application of large scale editing during writing (Daiute, 1985), categories and classification using database (White, 1987), or the transfer of general problem solving skills to other situations (Salomon, Perkins, Globerson, 1991), indicates that deeper processing may not occur. Perkins, however, tempers his initial concern with the suggestion that "first order effects" occur spontaneously - people will use the tools in ways that they consider convenient, to carry out the same tasks they have always performed. "Second order effects", may not occur because the conditions under which these effects happen are not always met. Two different sets of conditions exist which will promote the taking of opportunities to achieve second order effects acknowledges Perkins. One is a "low road" of extensive and varied practice, the other a "high road" of attention to principles and a mindful

approach to problem solving; but to achieve widespread benefit from either approach requires a contriving of those conditions, as may be carried out during schooling.

The most recent expression of Perkins proposals within New Zealand Music Education is seen in the 1984 Review of Music Education and the resulting National Syllabus - Early Childhood to Form Seven (Department of Education, 1989). A summary table from this Syllabus, 'Emphases In The Spiral Curriculum'(p.9), is supportive of Perkins' proposals at different ages. The emphasis in early childhood is for students "to enjoy imitation and repetition...learning actively through discovering sound and improvising", leading to the secondary school emphasis on "competent performance of more extended compositions" (p.16) and development of "important cognitive processes, such as imagining and lateral thinking" (p.5). At secondary school in particular the aim is "to extend and refine musical expression". This is a process "which may be more influenced by social factors than musical ones" (p.16).

2.2 Computer Partnerships - Problems and Challenges

Microtechnology in its various forms is opening up exciting new worlds both for learning and for creativity in music education. Regrettably, a polarity has emerged in the way that music educators have utilised this microtechnology. In the two countries which have been at the forefront of technological innovation in education - the United States of America and the United Kingdom - there has been a definite gravitation towards, on the one hand, the almost exclusive use of microtechnology for instructional purposes, and on the other hand, towards the almost exclusive use of microtechnology as a tool for creative music making in schools (Stevens, 1988). Although each approach is undoubtedly highly appropriate for achieving the specific music learning and creative music making of the respective national systems of music education, there is a need for music educators to be far more eclectic in their approach to microtechnology in music education if its benefits are to be fully utilised.

Overview of music composition software

As suggested earlier music teachers have had difficulty finding a place for the computer. Many have not begun to take advantage of the computer as teachers in other subject areas. The following overview of music composition software reveals several reasons why music teachers may be reluctant to encourage composition with computers.

Firstly, the use of computers to help teach composition is a recent development. Although music educators have used mainframes and then microcomputers for at least 20 years, computer support and integration in music education is still in its infancy. Learning how to make use of computer applications takes considerable planning with the right information (Placek, 1985).

Secondly, music composition software, at 12 percent of the available total, is not as common as other music packages (Figure 1 gives an analysis of Apple II series software, Steinhaus, 1987). Composition software packages range from those a beginner could use to hardware combinations sophisticated enough to create professional recordings. About 76 percent of the music software on the market is CAI. 'Utility', comprising the remaining 12 percent, includes : data base packages (e.g.,inventory control); programming tools, such as machine language routines designed to facilitate the use of music as a part of other software; music printing software; and tools for composers such as wave form data files and supplementary music editors.

Software other than composition tools used in conjunction with music instruction can be divided into a further four categories: drill, tutorial, game and testing (see Figure 2).

Figure 1. Music software for the Apple II series.

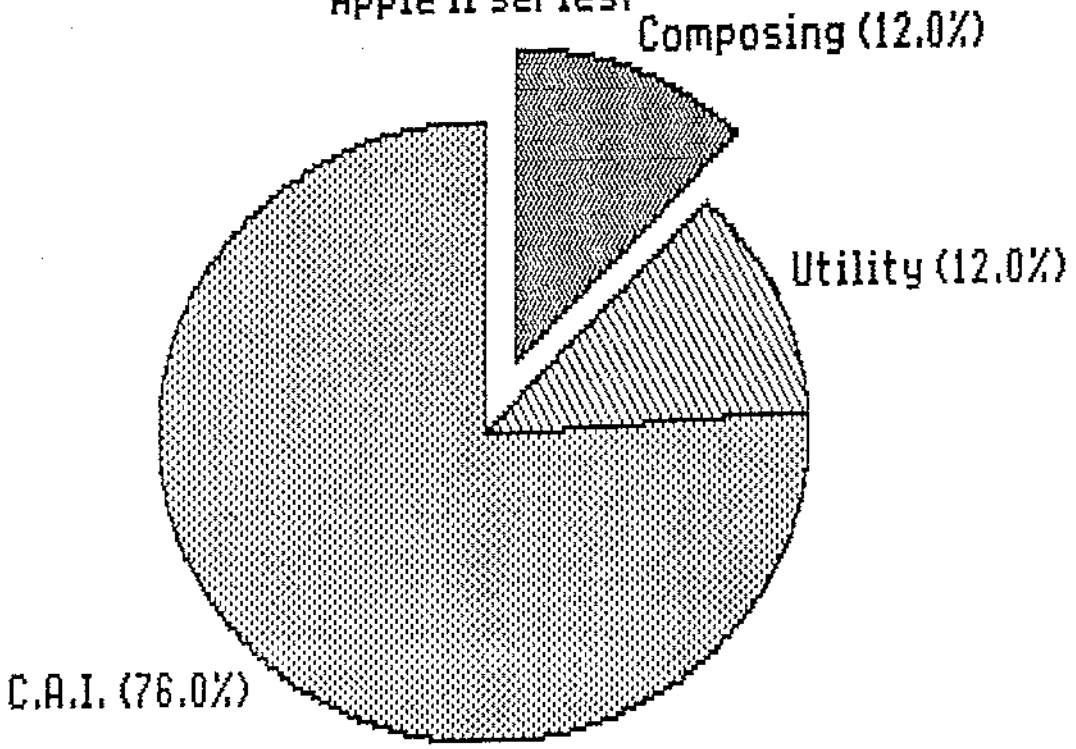
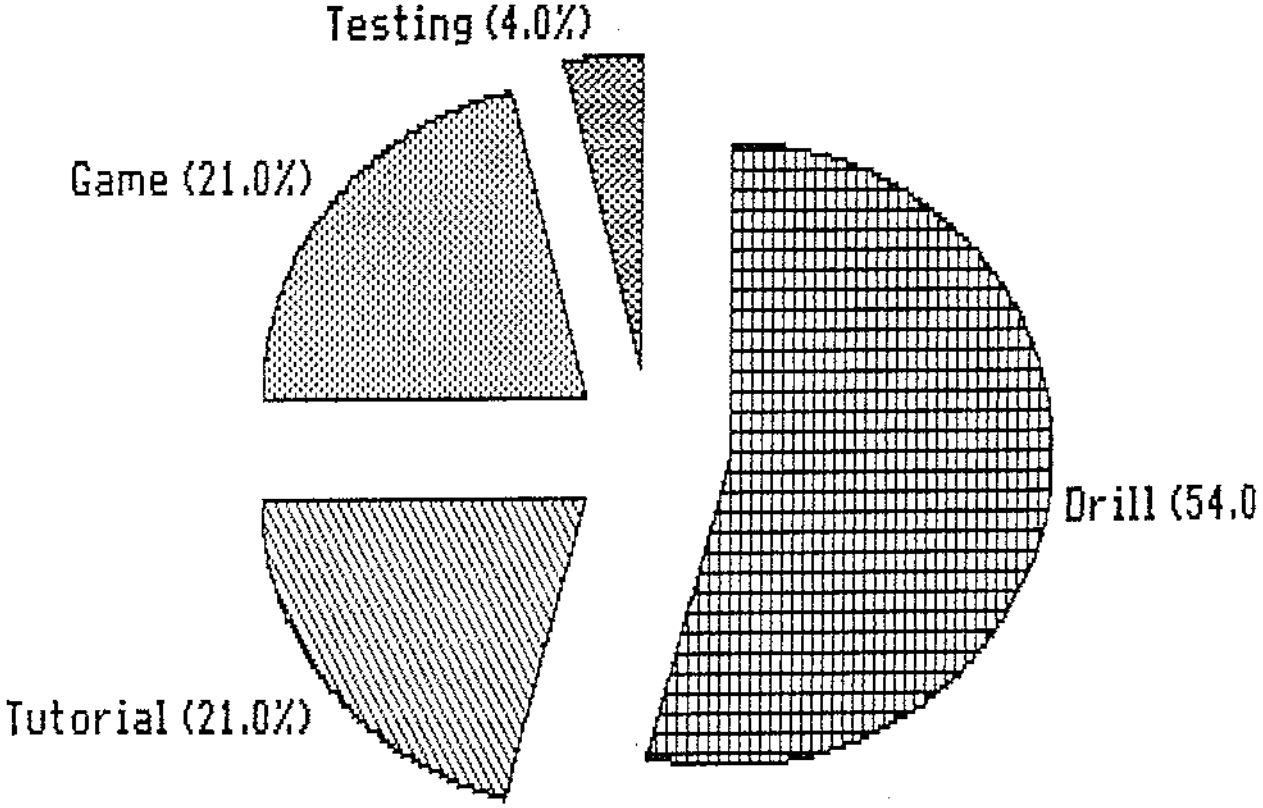


Figure 2. Software other than composition tools.



The Computing Teacher. December/January 1986-87 p16

Adapted from :Steinhaus, K. (1987 [a]). Putting the Music Composition Tool to Work

A third factor is the paucity of education-based courses for teachers which consider ways of putting music computer tools to classroom use. As a general rule in New Zealand, courses are carefully marketed by companies within the commercial sector with little interest in educational objectives. Industry-based courses tend to be technologically driven, with attention given to sophisticated computer effects and to learning technical skills like commands for arranging a page of notation.

A fourth, perhaps more pervasive factor, is the general reluctance of music teachers to develop composition skills in music programs. While music performers are regarded as special or talented compared to the rest of the population, composers are seen as an even rarer breed (Upitis, 1983 [a]). Perhaps the main reason that composition is not developed is that it is simply not required or encouraged. This trend is may be compounded by teachers' fear of using electronic media for composition. Kassner suggests that teachers' 'technophobia' may prevent some students from reaching their full potential (Kassner, 1988).

Recent developments in interactive software are, however, bringing fresh challenges to the process of music composition. Personal computing aficionados have witnessed major changes in the user-friendliness of music systems over the past few years. Complex cognitive strategies such as inquiry, hypothesis testing, discovery and research are encouraged in these more open ended, interactive learning environments. Commensurate with this shift away from instructional systems to more learner-based interactive systems has been a focus on software which allows learning to be experienced in process terms.

Process-orientated software

The following brief summary of recent process-orientated software considers, firstly, three composition programmes designed to encourage exploration, and secondly, interactive software used in an "intelligent technologies" sense - as computer partners undertaking significant intellectual processing on behalf of the user (Salomon, 1991 p.2).

Firstly, Activision's 'The Music Studio' and Electronic Arts' 'Music Construction Set' offer free-form composition tools (i.e., movable drawing symbols) and user-definable sounds. The emphasis in both programs is to give a wide variety of composing features, but still be accessible to beginners. The opening screen has, in addition to the menu, icons for notation, volume, speed and pitch, transposition and key changes. Both programs are quite widely used in New Zealand and Australian schools.

An interesting offshoot of these two programs are software packages that accompany the users creative efforts. An example of such a helping program is 'Instant Music' - software that "won't let you make a mistake - unless you want it too" (Bateman, 1987 p.20). The software does this by keeping the user in the right key and rhythm no matter what is played. The mouse can also control one instrument as several other instruments play a composition. No matter where the mouse is on the musical staff, the key and rhythm are correct and following the melody. The computer becomes a musical partner. Bateman comments that the experience for a nonmusician "is both fascinating and educational"(p.20).

Research using interactive systems to aid aural training was pioneered by Lamb and Bates (1978). Lamb also developed a series of interactive games called Musicland where the student can experiment with elements such as timbre (i.e., tone colour) and melodic shape and form, and try common transformations used in composition such as transposition (i.e., changing keys), and retrograde inversion (Appendix Five). Rather than entering commands from the computer

keyboard a graphics tablet and various stroking interfaces are used. The notation system used is strikingly different from conventional notation. Although the staff is preserved, different colours are used to indicating timbre, and different-sized triangles are used to depict note durations.

More recent software packages have also been influenced by developments in artificial intelligence. Experimental composition software, for example, is more concerned with exploring novel musical questions than rivalling known aesthetic qualities. Conventionally composers specify every note, every event in a piece. "To compose algorithmically is to specify process rather than single events. For example, start low, end high" (Scholz, 1990 p.56). A stochastic approach is taken by Cool Shoes' Sound Globs. The user draws detailed probability curves for pitch range, durations, loudness, and horizontal (melodic) and vertical (chordal) density. It tends to produce music in which texture, not melody is the salient quality.

A second example, of experimental composition software is Hip Software's HookUp, which is icon based. This program uses intuitive interfaces such as counters, switches, clocks, sequencers, and arithmetic and Boolean modules (i.e. a symbolic language representing mathematical relationships, for example, 'A.B' means B follows A). The user needn't learn any command or function syntax, yet their power and flexibility goes beyond typical applications.

Interactive and intelligent computer tools offer a partnership with the potential of extending music composition possibilities, but if the context for human change is ignored these possibilities may not be fully realised. The degree to which this potential is realized greatly depends on the user's volitional mindful engagement. Perhaps more important than what student's are interacting with is how they are interacting.

Once students progress beyond the level of basic skills further development may require more complex cognitive strategies. If individual learner achievements are conceived as outcomes of instruction, they tend to have a narrow focus on such learning outcomes as acquiring propositions, skills, attitudes and values. Cognitive gains involving mental processes such as receiving, storing, processing, retrieving, and applying information are much broader. Students need to bring into play such internal and interactive processes as inquiry, hypothesis testing, discovery and research. These processes may be dependent on the type, extent, and quality of interaction within the computer culture which surrounds the use of educational software tools.

The focus on the interactive nature of learning points to the need for a variety of methods to assess cognitive and affective development. Research methodologies which allow open ended, process-oriented outcomes are critical to understanding student learning in this environment. An approach which analyses the social and cognitive interactions of students engaged in the process of music composition must be found. To provide the empirical basis for this present study, it is now necessary to consider music research on computer composition and student learning.

Music Research on Computer Composition and Student Learning

A search of the ERIC database using the DIALOG Information Retrieval Service during March 1990, revealed that most studies related music composition with computers to student learning in general terms. The weak link in these research articles is a superficial treatment of student learning with computers. Little is said about the nature of student learning with computers, classroom programmes, or teaching strategies. "That there is a gap between research studies and their practical application in music education is undeniable ..and papers based on research frequently deal with statistical validation of studies which do little to improve teaching or learning" (Kuzmich, 1987 p.212).

Research approaches that related music composition to student learning are briefly considered. They are grouped into two categories. The first omits the computer, describing instead composition, creative ability, and classroom practice. While composition is not carried out on a computer many of the principles and guidelines are redily applicable to group learning situations with computers. The second category considers research about music composition using computers. Several aspects of the research cited are applied to this study.

2.3 Non-computer Composition, Creative Ability, Classroom Practice.

Sloboda (1985) examines two theories for explaining the process of composition. The first, he calls 'sketching', proposes that composers complete detailed work on successive revisions in much the same way as the multiple revisions of Beethoven's manuscripts. The second, called 'dictation' proposes that students compose from an inspired vision, in much the same way as many musicologists suggest Mozart did. Thus, Mozarts dictation appeared to proceed from the top of the page, complete in itself as a ready formed unit. However, to highlight one method over the other may be an oversimplification as most composers exhibit both 'inspiration' (i.e., dictation) and 'perspiration' (i.e., sketching) notes Hargreaves (1986, p.142).

In this study the assumption is made that all students have creative ability. That is creativity is a normally distributed trait which everyone has. Creativity is seen as a mundane, everyday aspect of behaviour which can be observed in the activities of students as well as in the works of great artists. A focus on 'everyday creativity' as a quality which is possessed by all is taken in an attempt to alleviate the view of composition as something mysterious, unconscious, irrational, and anything but ordinary. A challenge for music educators may be to de-mystify' music composition.

It seems likely that some students inhibit themselves from composing or playing an instrument because they think that they lack the ability, rather than because they necessarily do. In Picasso's view - "Paintings are but research and experiment. I never do a painting as a work of art" (Hargreaves, 1986 p.143-146).

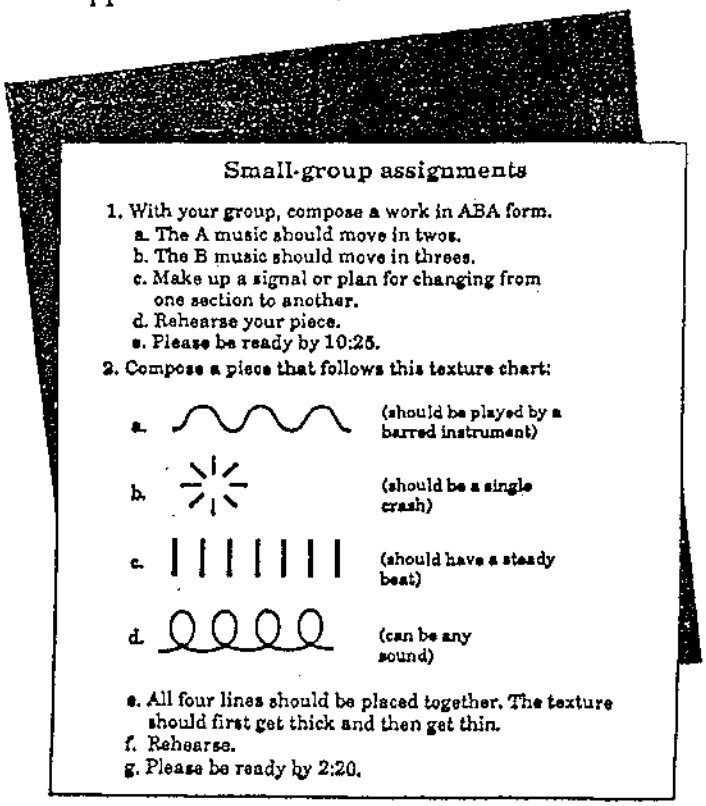
Musical Aptitude Research

Research into musical aptitude aims to discover what students are capable of musically. This may be distinguished from musical achievement, which aims to discover what students do musically. Observation and experience, as well as experimental research (Shuter-Dyson, 1968) have shown that individuals differ widely in their musical aptitude and therefore musical potential. Some students show signs of musical aptitude very early. They may display curiosity about a musical instrument, or their own voices. They may be eager to join in with or imitate the social music-making of others. Research suggests that student's "mature" in their aptitude by about fourteen years of age. Music Aptitude tests such as the Bentley, or the longer Gordon Music Aptitude Profile (Gordon, 1965), are usually norm-referenced.

Classroom Practice

Seminal research into creative problem solving in art philosophy and music education led Kuzmich to propose the use of "creative problem solving techniques as a basis for composition" (p.212). However, her methods for promoting creative problem solving are unclear. The approach taken appears to be a form of peer learning in which older, more experienced students work alongside younger, inexperienced students.

Wiggins (1989) describes three classroom based approaches for composing music: teacher-guided composition; small-group composition; and individual free composition. Her approach is largely descriptive. Students begin most of their individual music compositions in the context of small group assignments (Figure 3) and "The most important aspect of teaching composition ... is that students are no longer dependent on the teacher" (p.38). An example of this small-group approach is shown.



Small-group assignments

1. With your group, compose a work in ABA form.
   a. The A music should move in twos.
   b. The B music should move in threes.
   c. Make up a signal or plan for changing from one section to another.
   d. Rehearse your piece.
   e. Please be ready by 10:25.
2. Compose a piece that follows this texture chart:

a. (should be played by a barred instrument)

b. (should be a single crash)

c. (should have a steady beat)

d. (can be any sound)

   e. All four lines should be placed together. The texture should first get thick and then get thin.
   f. Rehearse.
   g. Please be ready by 2:20.

Figure 3 : Small-group composition assignment.

From: Wiggins, J (1989). Composition as a Teaching Tool. Music Educator Journal 75(8).35-38

Traditional composition techniques such as writing balanced, classical phrases or following harmonic rules to create melodies based on chord structures were not taught by Wiggins. "Students can make structural decisions (with the help and guidance of the teacher) that allow them to tap their creativity" (p.36). The thrust of her programme is written-down improvisations. Students may notate their work with standard notation or their own symbols. Students evaluate compositions in terms of how well each composition fulfils the requirements of the worksheet or assignment. The good points of a composition are recognised by other members of the class. Individual free composition is attempted only by students who have had other group composition experiences.

2.4 Music Composition with Computers

The LOGO music system was developed by Bamberger for use on the Apple IIe (Upitis, 1983 [a]). A typical LOGO music exercise requires students to manipulate musical passages called tune blocks to create original compositions. Other exercises for exploring musical perceptions include exercises on rhythm, motivic analysis, and the use of canons or rounds.

A disadvantage of the LOGO music system is that a numeric system is used to depict pitch, and no visual music displays are available. Students must therefore equate the sounds they hear to the numbers they see which represent pitch, duration, dynamics and texture. This system contrasts sharply with other more interactive systems using a similar game format (e.g., Lamb's "Musicland", in 'Computers for Intellectual Exploration').

Flagg (1986) used The Music Shop and Bank Street Music Writer to aid composition with younger children. Students worked on a composition project with the goal of obtaining "printouts of the compositions they had computerized" (p.30). Printouts were displayed with titles and names of student composers. A public concert of student work was also given.

Flagg's teaching programme focused on standard notation elements "melody, form, tempo, harmony, notation and the like"(p.32). Compositions were based around rhythmic ideas. Students also experimented with the random selection of pitches. Teacher questioning was important during activities like the pentatonic scale, AB and ABA form, the twelve-tone row, retrograde, first and second time endings, triplets and repeat signs (Appendix Six: Music Terms and Concepts). For example, "how can an eight measure melody be turned into a sixteen-measure melody" (p.31).

In Upitis' (1983) research the potential of using the Apple II+ microcomputer with an ALF products music software system (nine voice) for computer-assisted instruction in composition was examined. Two boys, 8 and 10 years of age, served as subjects. Naturalistic observations were made as these students participated in a 10-session programme that consisted of composition activities such as adding harmony and writing rounds, and related activities, including listening tasks. Most of the composition activities, particularly the round or canon, were found to be useful vehicles for teaching both composition and other topics such as music fundamentals.

There were differences in the nature of the boys' compositions and in their approaches to the tasks. Although one subject preferred a traditional orientation to the ALF program and the other had less conservative musical preferences, the program accommodated these individual differences.

It was concluded that the ALF music system could be used to advantage on an individual basis in initiating interest in composition. Limitations of the program and system were also pointed out. One of the more significant findings was transfer of student interest beyond the teaching sessions to a variety of other performing and listening experiences.

Summary

The above review of the literature suggests that a variety of methods need to be used to measure the conditions under which students' learn to compose music. Several aspects of the above approaches to composition are incorporated into this study. They include : creative problem solving techniques; project work; assessment of compositions by individual and group grades; naturalistic observations; teacher-guided class composition and small-group composition; and a variety of worksheet based activities.

In an attempt to strengthen the case for student learning with computers and analyse the nature of the interactions that occur it is now necessary to provide more specific means of intervention. As recently as 1981, Johnson addressed student-student interaction, calling it "a neglected variable in educational research" (Johnson, 1981 p.5).

Recent research by Saunders (1991) on teaching of writing, Hertz-Lararowitz (1991) on problem solving, and Palincsar and Brown (1984) on reciprocal teaching of reading, employ some form of social interaction, social construction of knowledge, and collaboration. These studies all highlight an interest in peer learning. Researchers' impressed with the educational potential of peer learning have designed and tested a diverse range of peer learning techniques, generating in the process a substantial data base of findings (For a comprehensive analysis see Webb, 1991). One important area of peer learning that teaches social skills in the computer environment is cooperative learning. This method ties in well with the strategies approach.

Learning Strategies

Learning strategies in this study are defined as a set of tools that enable the student to activate and regulate cognitive activities such as attention, comprehension, thinking and problem solving. They are internally organised skills or control processes by which the learner regulates cognitive behaviour (Gagne, 1977). Related to this is the teachers role as mediator between the learner and the external world. The teachers role in structuring the learning environment focuses initially on cooperative learning followed by discussion of models for improving strategic behaviour in learning, thinking and problem solving situations.

2.5 Cooperative Learning

Cooperative learning is an umbrella term that loosely covers a wide range of group-based approaches. The common feature of these approaches is their division of classrooms into "teams", "achievement groups " or "learning centres" usually consisting of five or six students. The teacher presents a task to the group, and the group then sets out to master it. These learning groups are generally heterogeneous with respect to ability; and, although in some versions of cooperative learning, students will assume different roles, there is rarely a sense of superior status attached to any of the roles. The development of social interaction as a means to more effective learning and the idea that every student has the chance to participate in every problem-solving role are central to cooperative learning.

Equality means that both parties in an interaction take direction from one another rather than one party submitting to a unilateral flow of direction from the other; and mutuality means that the discourse in the interaction is extensive, intimate, and "connected" (Damon & Phelps, 1991 p.6). Different methods of cooperative learning yield fundamental differences in these two indexes and therefore can be contrasted on this basis.

This study adopts an approach similar to Johnson and Johnson's Learning Together method (Appendix Seven). Groups are encouraged to trust and depend upon one another. Student-student interaction is structured so that students:-

1. know they can only be successful if their group is successful
2. are accountable for their individual understanding and mastery of whatever is being taught
3. are given specific instruction in the social skills necessary for the group to be successful, and,
4. are given the opportunity to discuss how well their group is working and receive feedback to improve future performance.

A summary of the differences between cooperative and traditional learning groups according to Johnson and Johnson is given in Figure 4.

Cooperative Learning	*Traditional Learning*
Positive Interdependence	No interdependence
Individual Accountability	No individual accountability
Heterogeneous	Homogeneous
Shared Leadership	One appointed leader
Shared responsibility for each other	Responsibility for self
Task and maintenance emphasized	Only task emphasized
Social skills directly taught	Social skills assumed
Teacher observes and intervenes	Teacher ignores group functioning
Groups process their effectiveness	No group processing

Figure 4: What is the Difference?

From : Male, M, (1985). Whats the diference ? Cooperative Learning and Computers: An Activity Guide for Teachers. Mountain View, CA Mayfield.

Computers

Computers are ideally suited for such cooperative learning tasks because they provide the context for group problem solving (i.e. assignment to tasks, a common group goal, and immediate feedback). The teacher is then freed to guide students in the development of their social skills and learning strategies.

Hawkins (1982), for example, observed more peer interaction amongst 8-11 year-olds when they were working on a computer than when they were working on noncomputer classroom tasks. Junior high students have also stated a preference for working cooperatively with other persons rather than on their own. For example, when working in pairs on adventure programs, they took turns as recorder and computer operator (Ryba, 1987).

Male (1988) has provided the following description of how cooperative learning methods can be applied in the computer situation to support social development. She indicates that there are three important questions that need to be considered:

1. "How can we use the computer to create positive interactions among students, both regular and exceptional?"
2. "How do we ensure that computer experiences encourage the self-esteem of students?"
3. "How should classroom use of computers be organised so that students develop interdependence, good work habits, and a sense of their own competence?"

Learning together with computers encourages a positive interdependence among students' goal attainments; students perceive that they can reach their learning goals if and only if the other students in the learning group also reach their goals. Thus, students seek outcomes that are beneficial to all those with whom they are cooperatively linked (see also the initial game Appendix Seven).

2.6 Other Strategies

Other strategies used, which focus on the development of thinking skills are Process Composition (Pegler, 1989), the SPELT program (i.e., a Strategies Program for Effective Learning and Thinking - Mulcahy, Marfo, Peat & Andrews, 1986) and the IDEAL approach (Bransford & Stein, 1984). These strategies were chosen because MIDI enabled composition brings with it more time for students to discuss, explore, analyse and check problem situations and solutions and less time for handling and manipulating information. Strategies such as these are critical for enhancing students problem solving skills in a socially interactive and reflective learning environment.

SPELT is used to provide suggestions for the direct teaching of thinking skills. This approach, which emphasizes the progression from the lowest level of strategy acquisition (teacher-imposed) to the highest level of acquisition (student directed), reflects this studys emphasis on creating teacher-independent thinkers. A related approach uses the IDEAL model to break problems into specific stages. The IDEAL acronym breaks problems into specific steps: (1) Identify the problem; (2) Define the problem; (3) Explore solution strategies; (4) Act on the strategies; and, (5) Look back to evaluate strategy use.

This approach involves skills of analysis and planning which will be taught and practised. Wall charts and discussion of the stages students go through will be encouraged. Creative solutions to problem solving will be actively modelled by the teacher. A Process Composition Strategy (Pegler, 1989) is used to provide specific suggestions about the direct teaching of music composition. The main points in this strategy have been adapted from Steinhouse (1987) and are summarized in Table 2.

Table 2 : Stages in the Process Composition Strategy.

(1) PRE-COMPOSING:

Precomposing begins in childhood (singing, nursery rhymes or listening to music). Demonstrate the international use of the minor third. Imagine an idea. A mood, feeling, occasion, story, sound... Draw out students natural interest in music with pop tunes, note games, student compositions. Concerts, videos, abstract artwork, C.D./tapes, experiment with equipment...

(2) SKETCH:

Play around with ideas. Capture your idea using some form of notation eg. blocks of sound, written notes, line drawings. Shape your idea. Play around with this simple musical idea or motive. Does your "messing around" have a purpose (i.e., is the music for a party, a radio ad, your private company e.g., "Purple Elephant Recordings"). Record or write this draft without concern for correctness.

'Continuing activities', include:
talk, listen, observe others in your group, other groups
use the 'idea bank'- adapting others compositions is O.K.
Use ideas from 'Making a Tune Grow' & Appendices 19-21. # develop musical form or structure - chorus/verse, through composed, question/answering phrases, notation conventions .

(3) EDITING:

Self-edit first draft and highlight the best parts. Ask - did I "hear" a central motive?...make it interesting?... progress by steps?...repeat key ideas?..give it shape?..enjoy it? Play tune to a friend, making a tape of it, teach it to someone, print it out. Make changes. Organise a conference - this is a critical stage as students rarely show a desire to revise on their own.

(4) PERFORM/REVISE:

Play composition to a group. Peers evaluate. This stage may be a beginning because it might be the first time students are able to observe an audience reacting to their music, thus resulting in a whole new set of musical ideas; the end because it might be thought of as the final stage in a long and possibly arduous process. Consider all suggestions. Follow the most reasonable. Prepare a Final Draft.

Adapted from :Steinhaus, K. (1987 [a]). Putting the Music Composition Tool to Work. The Computing Teacher December/January 1986-87 p16-18

Process Composition

Composition in music is defined as 'the process of organising sounds so they are good to play and hear' (Winters, 1989 p.11). The terms improvisation, invention or 'creative music' fall within the given definition. Composition takes place when there is freedom to choose the ordering of the music. It includes the briefest utterances as well as more worked out and sustained invention. Thus, sounds may be heard for their own sake as pleasant or entertaining.

The central goal of the process composition approach is to create a simple musical motive which has the potential to be extended. The musical motive will then be reworked and added to until it becomes a instrumental piece with form

and structure. In this way quite simple ideas can be developed into more complex musical works. In broad terms composition can be defined as a series of musical trials, not a series of musical mistakes. The process of composing music has many direct parallels with the process of composing writing. Steinhaus, (1987 [a]) comments, that "the music composition tool does for composing what the word processor does for writing" (p.16). By concentrating on the process, by having it become a recognised element in the problem solving or learning situation, it is possible also to focus on the ways in which that process can be monitored and controlled (Anderson, 1989).

A brief description of the general strategies used in the process writing model (Graves, 1983) may provide clues to developing similar strategies in the area of music composition. The process writing model stresses the way in which students write, from pre-writing activities to final publication. The processing necessary to accomplish the task of writing an essay on a topic familiar to the student may involve several stages. The student must plan the essay, then translate the plan into sentences and paragraphs. Review and revision follow. Specific skills are learnt during the writing activity.

A recent research analysis of writing suggests that essay quality improves dramatically when students are taught these stages (Pressley, 1989 et al). These stages are a continuous circle, as the development of an artistic work usually does not follow a linear pattern. For example, after the beginnings of a story have been completed, a related classroom activity may stimulate additions, including conference sessions with the teacher, leading to revision of the original work.

Duke (1987) has used the process writing approach to encourage the use of integrated prereading, prewriting, and critical thinking activities in music classes to help students appreciate and understand the process of musical composition. Parallels with process writing made it easier for the students to create music when they have been introduced to these concepts during process writing lessons

(Wiggins, 1989). The central concepts include forming a main idea, sequencing, classification, and categorizing. Process writing curricula also introduce students to the concepts of writing by group and individual brainstorming, editing, and revising. The amount of attention given to each stage will vary from student to student. But conscious efforts will be made to provide students with experiences in every stage. The precomposing stage is emphasised as it includes experimenting with the software, gaining a basic understanding of how to use the music editor and practise with the operation of hardware and software. It should be noted that the strategy was not taught to the students in this form but in a simplified version called SAPP (Pegler, 1989).

2.7 Preferred Methodology

The complex demands of studying a 'computer culture' and analysing process skills for music composition suggests a variety of exploratory, open-ended approaches are necessary for an adequate understanding of student learning. To this end the potential of ethnographic methodologies in supplying information and insight for music education is regarded as promising.

Ethnography means, literally, a picture of the "way of life" of some identifiable group of people (Wolcott, 1987). These people could be any culture-bearing group, in any time and place. Historically such a group was usually a small, intact, essentially self-sufficient social unit and in some way "strange" or unknown to the observer. The anthropologist's purpose as ethnographer was to learn about, record, and ultimately portray the culture of this group.

Ethnographic methodologies are a key to understanding how groups compose music because they consider the effects of situational influences. By observing how students in particular settings make sense of their world, the meanings given to events and the underlying beliefs and values that shape behaviour can be explored. By describing these educational events in detail and examining the relationship of events, one may begin to understand the overall picture as well as interpreting what the learning experiences mean to student's.

Educational ethnography has evolved from sociology, psychology, and anthropology, and may be defined as single- or multiple-setting case studies developed with a specific process in mind. Ethnographic methodologies allow for the discovery of unanticipated questions and outcomes, and the observation of a wide variety of events.

A variety of data collection techniques such as observations, interviews, materials analysis, and occasionally surveys may be used. It is the "triangulation" of this

research methodology, obtaining information in many ways from several strategies and measures rather than relying solely on one and a focus on the natural flow of events, that make it well suited to examining the complexities of everyday interaction in classrooms and to exploring the institutional structures that shape that interaction.

In this multi-instrument approach the researcher is one of the research measures or instruments. In gathering information the researcher utilizes observations made over a period of time from multiple sources of data and employs multiple techniques for cross-checking and ferreting out varying perspectives on complex issues and events.

By being on the scene the researcher is afforded continual opportunity to ask questions but also has the opportunity to learn which questions to ask. The researcher should be open to change and development as a result of encountering the action of being studied. The research framework may be therefore be altered due to events observed during the study.

While there is no standard approach for enumerating the most commonly employed ethnographic methods, they can be organised into four broad strategies:- participant-observation, interviewing, use of written sources and analysis and collection of nonwritten sources. These are briefly described in turn.

Participant-observation has been described as a process of waiting to be impressed by recurrent themes that reappear in various contexts (Cohen, & Manion, 1980). It concerns roles and expectations and looks for explanations as to why people behave the way they do. The intent is to identify significant features of the learning environment. Genuine participation, however, has costs as well as benefits. The closeness of the researcher to the students brings with it the tension between involvement and detachment. With too much distance and perspective, one is labelled aloof, remote, insensitive, superficial; with too much familiarity, empathy, and identification, one is labelled as unobjective and

partial. In school related studies it may be the researcher telling what everything means (and perhaps even how things should be) rather than allowing those in the setting to give their vision of their world.

The second strategy, interviewing, may include in the broadest sense anything that the researcher does that intrudes upon the natural setting and is done with the conscious intent of obtaining particular information. Cohen (1980), includes the formal interview in which set questions are asked and the answers recorded on a standardised schedule; the less formal interview which gives the interviewer scope to modify the sequence of questions, change the wording, explain them or add to them and, the completely informal interview in which the interviewer may have a number of key issues which are raised in conversational style.

Two corresponding interview techniques of note are the structured and unstructured interview. The structured interview is one in which the content and procedures are organised in advance. This means that the sequence and wording of the questions are determined by means of a schedule and the interviewer is left little freedom to make modifications. When some leeway is granted it too is specified in advance. It is therefore a closed situation. In contrast, the unstructured interview is an open situation, having greater flexibility and freedom. Although the research purposes govern the questions asked, their content, sequence and wording are entirely in the hands of the interviewer.

Thirdly, use of written resources may include - letters, diaries, archives. All kinds of written records may be used, not only those available in libraries. In working with populations that include school-age children, ethnographers have sometimes sponsored essay competitions to encourage students to write of their experiences.

Fourthly, analysis and collection of nonwritten sources may include - maps; household composition; glossaries; descriptions of ceremonies, songs, chants.

Photographs, films, or artifacts used in analysis and write-up may test the adequacy of the researcher's developing descriptions and explanations. Audio/video tapes and photography have also been used.

Underlying the choice of ethnographic methodologies several assumptions are made. The first assumption is the belief that a predetermined hypothesis should be avoided in the investigation. The investigator should attempt to remain sensitive and open to the ways in which the students', rather than the researcher, make sense of and give meaning to experiences.

A second assumption identifies the student's themselves as important sources of data; both their actions and statements about their actions, ideas, attitudes, and beliefs are important. Implicit in this assumption is the notion that intentions are important, and that circumstances alone do not determine actions.

The third assumption gives consideration to social and institutional conditions that enhance, shape, or limit actions and events taking place. Based on these assumptions, educational ethnography maintains the importance of examining intended and unintended actions and outcomes in an attempt to understand what actually happens in schools.

2.8 Summary

The introduction outlined the main ideas covered in this study and signalled the intention to explore the place of computers in secondary school music. The place of computers in the learning process was then considered with a view to examining ways of empowering students to become more effective and self-directed learners.

Research suggests that student's ability to exert control over learning may not be so important as their internal sense of feeling in control. The feeling of being in control may be enhanced in a learning culture which encourages positive social interaction as a vehicle for intellectual growth.

The role of teachers and computers as partners in constructing environments that enhance reflection and self-regulation activities is critical. Metacognitive skills developed in this environment provided a basis for learning how to learn. In particular, there is a need to study in more depth the kinds of interaction that occur and the influence of the wider context.

A historical analysis revealed that early instructional methods tended to oversimplify and even rule out the role of people and culture. Later research began to consider the social and cultural context of learning, suggesting that how student's learn may be as important as what they learn. The ecological model was proposed as an over arching perspective bringing together aspects of the perspectives discussed.

2.9 Intent of the Present Study

This study is an initial attempt to redress this imbalance. It takes a fresh look at cognitive theories such as Vygotsky's (1978) which reemphasises the vision that intellectual growth is a dynamic social-interactive process by which students grow into the intellectual life of those around them, namely their peers and adults.

The type of evaluation and intervention measures used is based on the assumption that exploratory, open-ended methods should precede experimental research. Rather than observe students in a highly structured cooperative learning environment some leeway is granted to encourage student creativity and to allow for the influence of social-cognitive processes on interaction (Salomon, 1990). As a result it is hoped that motivational, perceptual and attributional outcomes may come to the fore. In this way the natural flow of classroom events and reasons why students act as they do may be more fully examined.

CHAPTER THREE
CONDUCTING THE RESEARCH

The following chapter provides details relating to class composition, ability, research setting and programme. Firstly, an overview is provided giving the general procedure, the participants, and permission. Secondly, the teaching and learning context is considered. In this section the duration of the study, physical layout, regional, local and institutional influences are examined. Thirdly, intervention measures are highlighted including selection of cooperative learning groups, initial concerns, the teachers role, cooperative learning and other strategies, teaching content and resources, and computer/software resources. Fourthly, the evaluation measures used are outlined and reasons given for their inclusion.

3.1 Overview

Students in the study had two periods per week devoted to composing. The third period was group instrumental tuition on : flute, clarinet, cello, violin, and guitar [a]. The composing unit was divided into two cycles over the six week period. Cycle One encouraged exploration of the MIDI systems and group-building activities. Cycle Two provided opportunity for more in-depth processing of music using the elements: melody (motive), harmony (chords), bass line and rhythm. Complex thinking processes like synthesis, analysis, sequencing, debugging, and arranging were encouraged as students combined these elements.

[a] This pattern was broken only by a concert which was highly motivating. Several students arranged six notes on a magnetic stave to make a motive. The two concert artists then arranged and performed each of the students tunes on violin and piano with exceptional skill and virtuosity. The idea of a motive forming the basis of a longer tune was strongly reinforced.

The students were divided into five groups to help provide contrasts in aspects like musical aptitude, computer experience, musical experience, and social preference. This was done to examine how the above factors might influence student learning. The structure of the group (e.g., previous musical experience) was observed to see if it had an influence on how the students learnt to compose music. Consideration was given to how students interacted and solved problems together. Factors influencing interaction and learning were explored using process orientated questions.

During the lead up to and participation in the final assessment students participated in five cooperative learning roles (e.g., checker). Students were encouraged to move around and consult with one another so they could learn from the others. The learning environment was monitored using the computer culture checklist (Appendix Three). Students rotated around the following five workstations. This procedure was found to create a number of unanticipated problems as later discussion shows.

1) Music Room (D-20 sequencer),
2) Music Department Office (Apple IIe - Polywriter),
3) Drama Room (E-10 Intelligent Keyboards),
4) Sound Studio (Amiga computer - Sonics program),
5) Studio One (Amiga computer - Sonics program).

3.2 Participants

The study was carried out in a secondary school of almost 1400 students. Participants were initially 31 students (one student left school in the first week and his results are not included) from a Form Three Option Music class comprising 13 girls and 17 boys. These students started music as a chosen Option, mid year, beginning on the 9th July 1990. They had not been together previously as a class group and many students had five months previously come from small rural schools.

One male student did not attend Group One until the end of week two. One female student only attended Group Three in weeks five and six. Their results are included. Excluding the two students mentioned, several of the students were on behaviour or attendance reports as a result of non-attendance and/or disciplinary matters. Students on special report were, however, in attendance during this program.

None of the students indicated that they had used a computer in conjunction with classwork before. Although several from each group reported using computers at home or their parents work, none had used composition software before.

3.3 Permission

Permission was obtained from the Associate Principal and HOD music in April 1990 to conduct research within the school. This followed earlier discussion clarifying the nature of the research. During June 1990 a meeting involving the school principal and teacher-researcher was held to discuss the research and to invite the principal to attend the final group presentation as an assessor.

3.4 Teaching and learning context

Several essential points relevant to the research intervention are brought together in this section as cognitive and social development must be related directly to one's experience, purpose, and motivation within a relevant social-cultural context. The main points of concern are the duration of the study, physical layout, general procedure, and regional setting.

Duration of the study

The study was conducted for six weeks as part of the researchers normal teaching programme. During this time two cycles or levels of composing activity

were introduced around the idea of motive development. It was planned that important aspects of the first cycle would continue into the second, including, exploration of students' own ideas, familiarity with sequencing and composition software operation, and competence in most aspects of application use.

Physical layout

The study took place in a suite of eight rooms designed as a music and drama teaching area. This includes two hall changing rooms, two music studios, a drama room, an instrumental resource room, a music office, and the main music room. The suite is attached to the back of the school hall. All rooms are under the same roof and separated at the most by two doors.

The music suite is located near the school perimeter and distant from the school centre. This caused some students to cover a wide physical distance between subjects resulting in tiredness and anxiety over lateness. This was compounded by a timetable structure which drew students from as many as twelve other subject or special needs areas prior to the lesson. Interruptions were frequent including movement of classes to and from the nearby horticulture plot, hall, and drama room; phone calls; traffic from the roadway outside; and noise from nearby playing fields and construction of a ring road immediately outside.

Regional Setting

The school is set in a predominantly rural community. The region as a whole has a strong agricultural base and many of its economic and business activities are centred in the township. This is reflected in several facets of school life. In the curriculum, for example, all third formers complete farm duty. There is also an attached boarding school attracting around 170 rural students from as far afield as Auckland and Christchurch. Related to this is a daily bus population of around 200 students commute from outlying country areas. These factors may have a significant influence on the ethos of the school.

3.5 Intervention Measures

Effective learning may be best sustained in a socially interactive and reflective learning culture. Such a culture supports and nurtures student's intellectual growth in the context of positive relationships. It encourages students to develop comprehensive approaches to problem solving so that they may become independent, self-directed learners. However, a critical factor in the development of such learning cultures is effective intervention. The following section outlines intervention measures used in this study. It includes: cooperative group selection, initial concerns and the teachers role, cooperative learning and other strategies, teaching content and resources, and computer and software resources.

Selection of cooperative learning groups

Students were selected for cooperative learning groups based on the Research Questionnaire (Appendix Eight) and resulting Sociogram (Appendix Nine); Bentley Musical Aptitude Test (Appendix Ten); Music Department Questionnaire (Appendix Eleven); and in light of the researcher-teachers previous teaching experience with the students. One student with piano playing skills was also placed in each group to enable the group to play and record their ideas more easily. The names students chose for their groups and criteria on which selection was made is given below:

1.'RAPPERS'	- Low Bentley Aptitude Test Results
2.'FIREBALLS'	- No Previous Computer Experience
3.'F.B.I.CREW'	- No Previous Training/Experience in Music
4.'THE REJECTS'	- Previous Training/Experience in Music
5.'PARTY ANIMALS'	- Social Grouping (from the sociogram)

Group One (i.e., Low Bentley Aptitude Result) was selected on the basis of students scaled Bentley test results. Group Two students were identified from questions 8 and 9 of the research questionnaire. These questions also gave an

students scaled Bentley test results. Group Two students were identified from questions 8 and 9 of the research questionnaire. These questions also gave an idea of student attitudes to computers as work tools as this may affect the effort made to learn (Salomon, 1983). Group Three - 'no previous training/experience in music', and Group Four - 'previous training/experience in music' were selected using their answers to Questions 10, 11, 12 and 15 of the research questionnaire. Previous training/experience included both vocal and/or instrumental work. The teacher's knowledge of students musical experiences outside school also had a bearing on student selection. Two students from group four were active in this way. Group Five students were chosen on two criteria: firstly, each person had chosen one other person in their group as a first choice of partner (with the exception of person three who chose nobody); and, secondly, these students had been observed worked together previously and demonstrated that they were compatible.

Selection Criteria

Criteria used in selecting the groups have a wide overlap (Table 3)[b]. A closer examination of the mutually exclusive criteria suggests several questions. For example, several students with a high Bentley have had previous musical experience. How does this influence student learning? What other characteristics exist in one group that don't exist in another? Some students could be in more than one group because of similar backgrounds. Will they do better in group A or B? Discussion of these questions is undertaken more fully in the next chapter.

[b] Bentley Test: A 'Hi'attainment is shown on the table if the student scored over 60%. Two students did not sit the test due to frequent absences.

Student	Bentley Aptitude Result	Previous Experience Music	Previous Experience Computers
1	Hi	Y	Y
2	Lo	N	N
3	Lo	N	N
4	Lo	N	N
5	-	N	N
6	Lo	N	N
7	Hi	Y	Y
8	Lo	N	N
9	Lo	N	N
10	Lo	N	N
11	Hi	Y	N
12	Lo	N	N
13	Hi	Y	Y
14	Lo	N	N
15	Lo	N	N
16	Lo	Y	Y
17	Hi	N	Y
18	Lo	N	N
19	Lo	Y	N
20	Hi	Y	N
21	Hi	Y	N
22	Lo	Y	N
23	Hi	Y	Y
24	-	Y	Y
25	Hi	N	Y
26	Hi	Y	N
27	Lo	N	N
28	Hi	Y	N
29	Lo	N	Y
30	Lo	N	N
	Hi/Low	Yes/No	Yes/No

1.'RAPPERS'- Low Bentley

2.'FIREBALLS'- No Computer

3.'F.B.I. CREW'- No Training

4.'THE REJECTS'- Previous Training

5.'PARTY ANIMALS' Social Grouping

Table 3: Group Selection Criteria

Initial concerns

On the research questionnaire several student's recorded their perception of 'music in general' as positive but 'school music' as negative. Freedom of choice in deciding what they listened to and played was shown by many students as being the main reason for this difference. Several students also perceived school music as 'classical music' and hence limiting to other styles and genres like "heavy metal, rap, dance, and jazz". One student, for example, wrote "school music has only drums, guitars, piano, but no rapping or dance groups".

In light of these concerns students own musical interests became the initial focus for intervention. Styles of music were discussed to identify their musical characteristics and attributes. These were listed. Students were encouraged to compose within a chosen style.

Teachers Role

Teacher questioning is an important element of intervention, prompting students in ways that encouraged them to consider their own thinking. The teacher used the checklist of questions in Appendix Three as a means of directing students to consider their own thinking during sessions. Teacher intervention through questioning was also important during interviews. These included:

- How well did we work as a team? Why?
- How comfortable was I with my role? Why?
- What did we learn that was new or interesting? Why?
- How could things be improved next time?

Groups of students were withdrawn from the composition program into a nearby room to create as little disruption as possible. The interviews lasted on average fifteen minutes. Informal conferencing also created further opportunities for discussion.

The teachers role is many faceted and includes the five other components previously mentioned. The teacher was involved as (1) planner; (2) manager; (3) facilitator; (4) guide; and, (5) model-participant. Modelling, for example, was essential in the early stages of track recording. During demonstrations of track recording on the D-20 sequencer individual tracks were muted during playback and students discussed how this made a difference to the total sound of the piece. The teacher facilitated discussion and posed problems while the group trialed the equipment. In this way emphasis was placed, not on the software as "teacher", but on the teachers role.

Cooperative learning strategies

Learning together was the cooperative strategy used to directly teach the essential components of cooperative learning (Male, 1988). Group and individual success was group dependent. Students were encouraged to work closely with each other, so that their group grade would go up. In particular individuals and groups were evaluated in relation to the following roles:

1. ENCOURAGER - makes thoughtful, helpful comments, is positive, takes an interest, makes sure everybody is involved.
2. RECORDER/READER - uses tape recorder and disks to make copies, reads instructions to the group from the daily activity sheet.
3. CHECKER - asks, have we completed todays goal, clarifies ideas and checks if everyone in the group understands the checklist and can operate the equipment.
4. MATERIALS ORGANISER - collects group materials bag, helps 'recorder' and files printed music
5. LEADER FOR THE DAY - organises group members so that the goal is completed
6. PUBLIC RELATIONS - gets ideas and help from other groups, checks that group members are happy and getting on with the job.

Learning together is based on positive interdependence among group members. This is the feeling that no one is successful unless everyone in the group is successful. Therefore, goals are structured so that students need to be concerned about the performance of all group members as well as their own. Students were encouraged to talk freely about what they were doing. They explained how they solved problems and what they were thinking - for example, "Now I'll check this one more time". Resource interdependence was encouraged by having only one bag of materials per group. It contained:

- SKC QX90 cassette tape (for final recording)
- 3.5 computer data disk (D-20 initialized)
- 3.5 computer data disk (Sonix initialized)
- 5.3 XIDEX computer data disk (Polywriter initialized)
- Clear plastic folio: flip file (For filing printouts)
- One record sheet per activity.

Having only one record sheet encouraged students to make consensus decisions and record a representative group answer. These resources also encouraged multiple revisions and several printouts.

Strategy use

Strategy use provided the framework for thinking, exploring, and creating. A process writing strategy was used to refine and develop students ideas over the six weeks. As the teacher presented each new concept - melody, chords, bass or rhythm - care was taken to write down what the students actually said without making judgements as to their correctness. These points were left on the board. Several comments were later refined as a result of peer scrutiny and teacher guidance.

Several related musical concepts were discussed. These included : repetition - decoration, sequence, rhythmic or organic growth, inversion, extension, augmentation, and diminution; phrases - extension, contraction; and modulation (see Appendix Six : Music Terms & Concepts). Musical notation was frequently added using tempo, dynamics, articulation and other musical markings. Students applied these points as a means of evaluating their compositions. They talked out loud about solving problems that arose.

At the end of week five, students summarized as a class the important ideas covered in previous weeks. Students considered, firstly, the elements from the composing unit that would make up a quality piece of music. Aspects of a pleasing performance were also considered (see Appendix Twelve). Secondly, other social factors from their group were also evaluated.

This discussion was the climax of the previous six weeks work. Many ideas and key topics were already noted on the board. Central themes and categories were highlighted. A final summary was prepared in which ten criteria with appropriate numerical weighting were agreed upon as a checklist for evaluating group compositions (Figure 5).

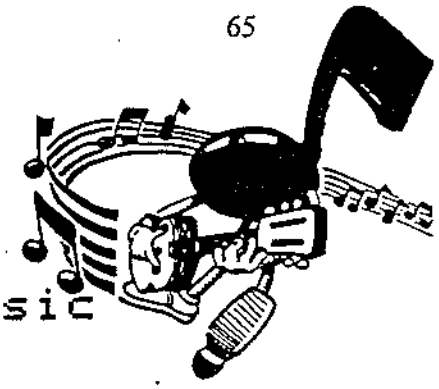
Students were referred to SPELT problem solving strategies and recording steps on the wall beside each of the workstations. The role of teacher intervention was also critical in developing the student's "metacognitive awareness". Observation and recording of student dialogue was made possible because students worked in small groups and the computer was the active, unseen partner presenting the information. This freed the teacher to record the interaction that took place.

Opportunities were available for students to compose music in standard notation using Sonix and Polywriter. Written notation work using pencil and paper occured in some groups. This is an important part of the composing process. However, if students want to hear what they have composed, mechanisms must

be in place to allow instrument(s) to perform their ideas. This can be difficult if parts need to be transposed, (i.e., changed in key) or otherwise altered. If you are writing an orchestral piece, it might be months or years after you've written it before you can get an orchestra together to play it, if you ever do. "By the time you go through the tedious process of copying out the score neatly, you have forgotten a lot of what you were into in the actual piece. When you finally hear what you tried out maybe you'll discover it didn't work" (Sheil, 1986 p.2-2).

The musical activities in composition, and arranging, are the creating of ideas, the experimenting, and the developing of these, not the notation. Writing dots on paper is a mechanical exercise, allowing a composition to be recorded for future performance (Orams, 1991).

EVALUATION OF GROUP MUSIC PROJECT



A good quality piece of music has:

1. A catchy RHYTHM (It supports the tune)_____ /10
2. A clear BEAT _____ /10
3. A recognisable MOTIVE or tune _____ /10
4. An accompaniment/CHORDS_ /10
5. A BASS line _____ /10
6. Interesting and appropriate INSTRUMENTS_____ /10
7. An effective PRESENTATION which includes- /2
   - HOW each person was_____ /2 involved
   - TITLE of piece_____ /2
   - WHERE the original idea came from_____ /2
   - HOW it was recorded_____ /2
8. TWO marks for each person who contributed_____ /10
9. Your groups OWN grade.___ /10
10. ORIGINALITY of ideas_____ /20

1	2	3	4	

Figure 5 : Group Composition Project - Assessment Sheet

Creating a Sequence

Active exploration of musical sequences was central to the development of metacognitive awareness. Composing a sequence required students to apply several problem-solving activities. Students initially used percussion instruments to organise sound patterns and motifs (Figure 6). Later sequencing activities became more difficult. Students were asked to combine several specific skills. In this way the ability to plan, monitor and regulate thinking were encouraged. Basing a melody on the underlying chord pattern, writing chords to fit a base line, or combining tracks - bass, chords, melody - sometimes led to unusual results.

Strategies that helped them record their musical style included breaking down complicated "problems into smaller parts" and the IDEAL wall charts steps for problem solving. Related teacher questioning included a focus on these steps - for example, "What is the first thing we need to do to solve this problem? Specific problems were isolated and reinserted into context. Students were encouraged to define the problem as this went a long way towards solving the problem. These sub-problems then became manageable parts of the composition process.

The following illustration on page 67 outlines the initial lesson plan and activities used. It has been adapted by the author from a series of articles in the Microtechnology Unit (1989) University of Reading.

Objectives

To discover the timbres of available classroom instruments and environmental sounds.

To organise sound patterns (varied) and motifs (repeated) into a balanced composition.

To discuss how variety (creating tension) and repetition (resolving tension) were used to developed a musical sequence.

Activities

* Discuss each picture with the class and determine the sounds and timbres which would be appropriate for each one.
* Divide the class into groups to create a sound pattern which would match the mood of each symbol.
* Create also a motif which can be used as a musical link between each picture in the story, thereby reinforcing same and different patterns.

Perform - Record - Playback - Discuss.

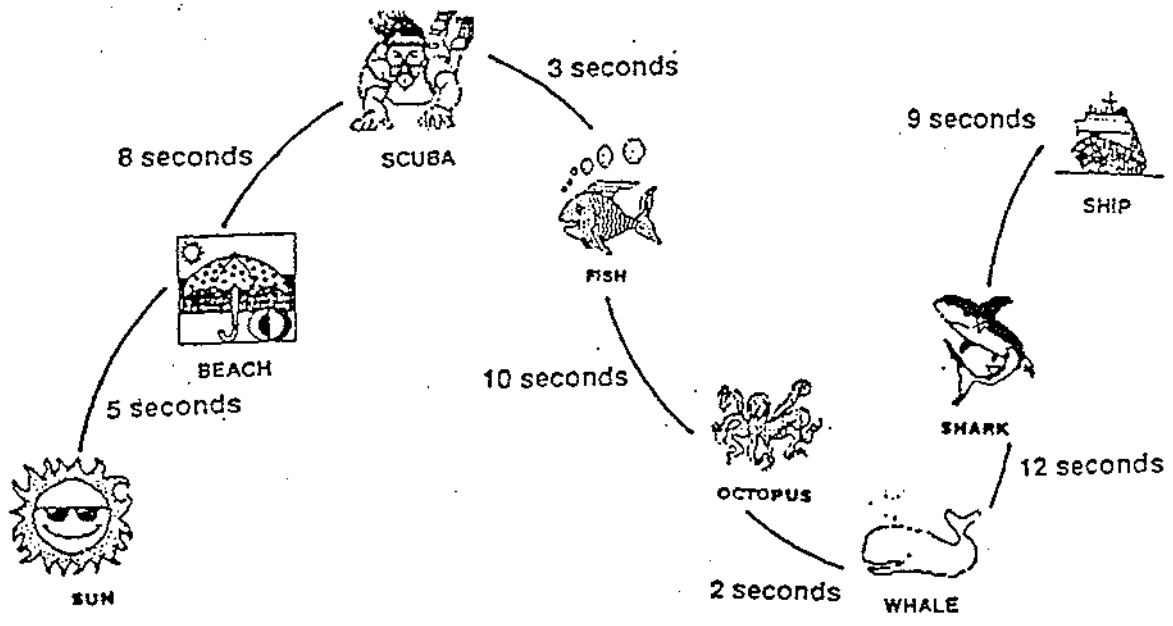


Figure 6 : Creating a Musical Sequence that tells a story

From - Music Education Centre. (1987) Microtechnology Unit. Information Update - Issue Four. Reading, England : University of Reading. School of Education.

The process composition model, S.A.P.P. (Pegler, 1989), was discussed and students were encouraged to use it alongside several worksheets about developing motives (Appendix Eighteen). The SAPP model complements these worksheets by drawing a parallel between growing music and growing plants which both need 'sap' to develop. The model outlines four steps for successful composition:-

SAPP - a strategy for music composition

1. SKETCH out, sing, or play a MOTIVE.
2. ADD notes to make the 'motive' grow.
3. PHRASE your tune so it has a shape, (e.g., question/answer).
4. PERFORM to others. You may want to record.

As an extension of the SAPP model students were also encouraged to evaluate their tunes. Does it have:-

a. A mood which is easy to catch; where there are words, the right mood.

b. A striking idea which is repeated (or nearly repeated) but not done to death.

c. A nice balance towards steps and leaps with perhaps some repeated notes for added character.

d. A sense of direction and climax.

e. A clear shape which is easy to follow and ends at the right time in the right place. Just as when we speak, phrases should be reasoned and articulated and may build to longer sentences or statements, so to in music.

Teaching content and resources.

The same content (i.e., controlled content) was taught to each group. Simple ideas were introduced by step and then applied in a cooperative group activity. Cards, activity sheets and guidelines were designed to be cumulative and sequential. Content was structured to progress in a spiral with students encountering more advanced forms of earlier concepts in the second cycle.

In cycle one students discussed and planned ideas for their projects around the theme of motivic development. They used "That's a Good Idea" ; "Developing a Musical Idea" ; The Symphony - Beethovens Fifth (Appendix Eighteen) and "Some Basic Music" 1,2,3, (Appendix Nineteen) to complete activities on : Chords, Bass and Rhythm. Students were also guided to "construct, test, probe and experiment" (Upitis, 1983 [b] p.56).

In cycle two seven worksheets were used (Active Music Book Two Dundar-Hall, 1987. Appendix Twenty). These worksheets were based around the tunes 'Mambo Rock', 'The Star-spangled Banner', 'The Blue Danube', and 'This Ole House'. The group goal was to compose or copy a piece of classroom music in a certain style. Students worked out the melody track and filled in the chords, bass, and rhythm. The extensive use of guidance sheets, wall charts, and teacher modelling of equipment at each of the workstations was intended to enhance student exploration and control of their own learning.

As students progressed in their understanding and control of computers they were encouraged to make choices about when and how to use computers. Conceivably, students could develop individual preferences and styles for using the computer along a continuum from not using the computer to using it for every stage of musical creation including analysis, arrangement and performance.

Computer and software resources

The thrust of this study was to empower students to become more effective and self-directed learners as a result of working with computers. One way this was done was through the careful selection of track recording software and hardware which allowed students control over separate tracks or lines of music (e.g. Melody). The resources used included:

1) 'Sonics' (Amiga computer and accessories);
2) a 'dedicated' sequencer (Roland D-20),
3) 'Polywriter' (Apple IIe and accessories), and,
4) six 'Intelligent Keyboards' (Roland E-10's)

The sonics software was chosen from a wide variety of available programs because both visually and aurally students could make alterations to each track and observe the way other tracks were altered as a result of what they had done (Figure 7).

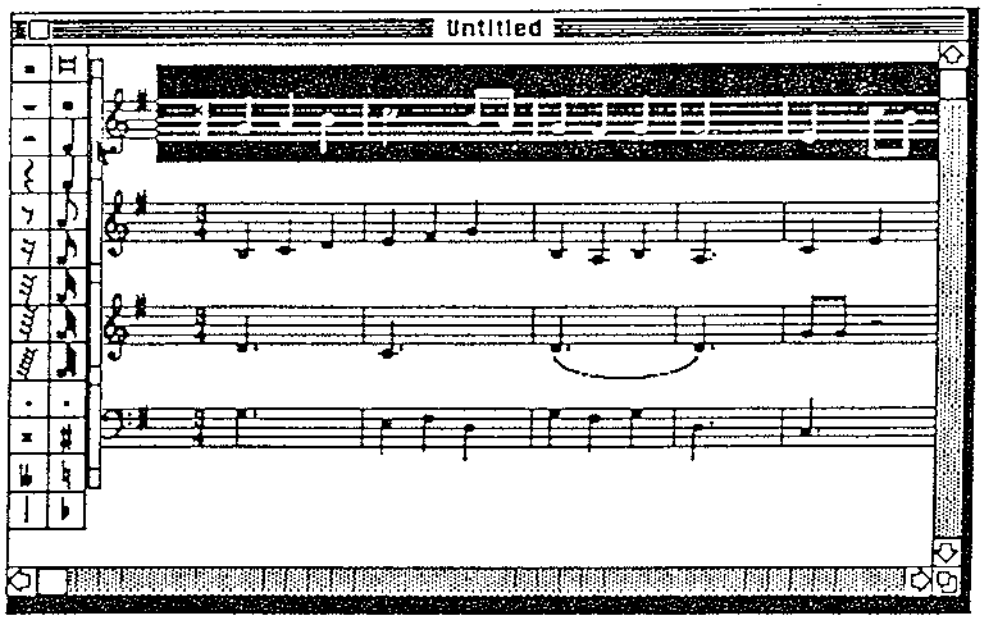


Fig. 7
Selecting the fir
stave to name t
parts.

Figure 7 : Track Recording Software

From Sonix: Manuel Number One. Computer Primer for Amiga Commodore Publishing. 1988

3.6 Description of Evaluation Measures

The evaluation measures include: a research and music department questionnaire, Bentley Musical Aptitude test, sociogram, student and teacher dairies, researcher intensive observation and members social skills sheets, reaction to groupwork and group skills sheets, interviews and student programme evaluation, and materials analysis. These are examined in turn.

The music department questionnaire was completed by all students in the second week of the year. It records students musical preferences, interest in school music groups, and the instrument that they wish to learn. It was chosen because it gathered a large amount of data quickly, introduced students to the composing course and let them know that their opinions were valued. Results reflect student attitudes, background and expectations.

The Bentley Music Aptitude Test was chosen because it is widely recognised as an accurate indicator of innate musical potential (Shuter-Dyson, 1968) and requires little or no musical knowledge or skill on behalf of the student. Information about the test items, scoring, and relative grades can be found in Appendix Ten. The sociogram recorded student's first and second choice of seating partner. A key is provided. It was anticipated that the sociogram would provide a baseline for analysing student friendships.

Student-diaries were completed at the end of each session in the back of their music books. They gathered information about student's perceptions of the session and group behaviour. Students discussed how their role went, cooperative tasks and what they considered they had learnt. The teacher-diary explored reasons why events seem to happen in a certain manner. It was useful for recording comments and responses as they occurred. Observations were discussed with students to help clarify and evaluate these impressions. Individual consultations with students during problem solving were also recorded.

The intensive observation sheet (Appendix Fourteen) records the specific social behaviours: explains concepts; encourages; checks; and organises work. Social skills of other group members (Appendix Fifteen) were also evaluated by the students themselves. This evaluation by students own peers was sought as a confirmation and balance to the researchers observations. Students gave a rating of other group members on eleven categories of social interaction. These categories ranged from 'expresses warmth', to 'criticises ideas, not people'.

Reaction to groupwork (Appendix Seventeen) emphasises group goals and roles. It gave an indication of how students performed on cooperative group tasks. The group skills sheet (Appendix Sixteen) a tick against a sad, happy or pensive face in relation to five skills : checking, helping, encouraging, finishing, and teaching. This evaluation measure was chosen because it encouraged qualitative comments under the heading "What was your group good at?". Group members were also helped to feel that their contribution was significant as a group because they were asked to sign their names.

Interviews were chosen because they allowed observation of student body language, facial expressions and other subtle nuances which were useful in the clarification and interpretation of student comments. Group members could be observed interacting and a wide variety of responses could be monitored. Comments were taped and typed soon after. This procedure was designed as a way of clarifying student meanings and analysing them while students were still available for comment. In particular, questions and issues arising from the first interview were addressed in the second interview to see if any changes had come about. The student programme evaluation recorded the groups perception of their interaction. It provided closure on the composing programme and a means of feedback for the researcher.

The researcher also designed and analysed several composition resources relevant to the research. These included activity cards, worksheets, cooperative

learning guides and wall charts. Responses to questions and instructions from these resources were written into student's self-diaries and later evaluated.

The criteria for assessing the final compositions (Figure 6) may be a way of providing meaningful positive reinforcement to students. Whether this was achieved is discussed under 'Process and Purpose' in the next chapter. As part of the assessment students were asked to say what their project was called, what had inspired them to compose it and how they went about composing. This introduction was given by a presenter, chosen by the group. The composition title, choice of MIDI-system and order of presentation are shown below:

1 Rappers	- Rappers Rap	(D-20)
2 Fireballs	- Balls of Fire	(Sonix)
3 FBI Crew	- FBI Jam	(D-20)
4 Rejects	- Rejects Hornpipe	(Sonix)
5 Party Animals	- Mambo Rock	(D-20/E-10)

CHAPTER FOUR
EVALUATING THE RESEARCH

The following discussion addresses the research questions outlined earlier. Firstly, an overview of the research is provided. Secondly, results of the intervention measures are discussed. An evaluation of micro-processor composition tools within a New Zealand context is suggested, and implications for the above questions considered. The main points are highlighted under recurrent themes - both those that were anticipated and those that emerged.

4.1 Overview

The study reported ways in which students learn to compose music with computers. It was suggested that optimum conditions for learning involved students in analysing and managing their own thinking in a positive social context. The emphasis on the active, self-directed role of the student led to discussion of how computer learning cultures promote this goal. A two pronged approach to computer learning cultures was adopted. The aim was to promote social skills through interactive groupwork and encourage thinking skills through problem solving strategies. The research results therefore focus on open-ended, process orientated learning rather than receptive, dependent learning. Results tend to be interpretive in nature. Names have been changed and numbers assigned to students to protect their identity.

Student Bentley scores suggest the class is of average to below average musical ability but that this ability is widely spread. Few students have completed private exams although a small number have a background in performing arts - particularly guitar playing, country and western music, singing, and piano. Bentley tests indicated that overall the class lay below the normal distribution curve for potential musical ability. These results range from 7% to 98% with a cluster of results around 16%, 59% and 82%. Two students recorded very high results and one student recorded a very low result.

4.2 The New Zealand context

The learning environment in the present study was of equal importance to the role microprocessor-based instruments played in providing access to data and enhancing students' capability to manipulate data. In contrast a technocentric approach centres attention on the object, for example, the computer or its software (Papert, 1987). This in turn denies the importance, in education, of teachers, students and the classroom environment. Acceptance of the computer as the sole agent of change may be inappropriate. Rather the computer is part of a larger social system including the student, the teacher, their history of past relationships, the history of ways of teaching, the history of ways of organising classrooms, the relationship between the classroom and the school, community and agencies beyond (Mehan, 1989).

Technosophistication

It appears that a number of New Zealand music educators have adopted commercial and political hardsells for computers and micro-processor based instruments without a great deal of thought for the surrounding learning environment or the hard work a real commitment to such tools brings. Such an approach is characterised by technoromantic thinking (Pea and Kurland, 1984). There is a naive optimism about the effects of using computers, especially concerning the spontaneous development of higher order skills.

A recent ministerial swing towards technology, with its focus on computers, may be moving education back to a "quick fix" technoromantic mentality. Comments implying "technology as a separate subject in your school" (Learning Media: Ministry of Education, 1992 p.12) appear to be gaining the support of SPANZ (Secondary Principals Association of New Zealand) and other prominent educational groups. The opportunities the keyboard-computer offers students to learn from one another may be a significant casualty of the current technological climate.

Students in this study were initially "starry eyed" about the electronic gimmickry. Their response points to the possibility that sophisticated computer effects may divert attention away from other important elements of learning. The use of intricate manuscript formatting commands, a wide selection of sound samples, or even the use of headphones may downplay opportunities provided by computers for students to learn off one another. The manner in which keyboards and synthesizers (i.e., workstation three and one) are being used in some schools illustrates this.

Students observed in some secondary schools with keyboard labs appeared to be intimidated as teachers secretly "listened in" while they worked on their compositions (Pegler, 1983). In the context of this research this practice is felt to be both unnerving for students and inappropriate for learning as it misplaces the feeling of student control. It is also unfortunate that some teacher comments tended to correct or instruct students rather than regard mistakes as a means to learning. Other schools with electronic keyboards used them particularly effectively because the variety of tone colours, rhythmic and other possibilities were employed for specific learning purposes.

Use of headphones, an individualistic classroom ethos, and fragmentation of the teacher's workload tend to isolate students from each other and the teacher. The job of teaching secondary music has many conflicting demands. Teachers are frequently caught at the centre of a complex web of activity and expectation. It becomes expedient to use headphones - to silence students, computers - for drill and practice, and keyboards - that virtually play themselves, in ways that promote classroom management and order rather than learning. Indiscriminate use of computers and keyboard-synthesizer labs may be an example of using technology to "deliver" instruction to the students without regard for people effects. The feelings students have about themselves and about learning with one another are as important as the technology and curriculum methods (Ryba, 1991).

In speaking of a labs advantages, commercial demonstrators and teachers alike have commented - "Isn't it great that you can be in control and listen in" ... "They eliminate a lot of chatter" (Yesterdays Schools, 1992). In contrast students in this study were encouraged to chat. The learning environment was structured cooperatively so that students composed their pieces of music in a group context and were encouraged to seek each others advice and assistance.

A wide variety of measures suggest listening to partially formed compositions is vital to facilitating dialogue. Musical compositions of greater complexity were generated as a result of peer scrutiny, criticism and subsequent student revisions. Drafts were re-recorded until a final polished version was submitted at a group listening concert.

Limitations of the equipment

Responses in students diaries and several other measures indicate frustration with the equipment across several groups. Mention of these limitations enhances the educational validity of the present study, provides insight into possible solutions, and highlights the learning processes associated with remediation. In the following cases learning was encouraged through the use of problem solving strategies and opportunities for more self-directed, student-centred learning became apparent.

In the first example, the D-20 sequencer was very quiet and students were facing away from its operating chart. Turning the D-20 around significantly increased dialogue. Due to space restrictions students headphones were connected together through a junction box. The resulting "silence" was punctuated by - "how do you get rid of the metronome!", and "could you record the drums while I play the tune?".

Secondly, obscure manual directions, machine codes and technical programming instructions meant certain functions using Sonics took a long time to learn how

to operate. After repeated trials at entering notation onto the screen one student commented "I finally figured out how to use the dumb computer". This is supported by comments during interview two by a student in group 4 (Note: From this point on reference to the interview text will refer to statements by the coding number in Appendix Fourteen).

T Did the computer help?

S5 No. Well apart from writing it all down for you. But we still had to figure it out=

S1 [Oh sure (accompanied by laughter)]

S5 =*we did!* (to the other group member) - *how to get it up there and figure out how the screen tapes music.*

Students found it frustrating that the save routine was a series of Basic commands. Such commands reflect the subtle biases of the engineers who designed the software. From an engineers perspective the Sonics software was probably simple to design and a predictable, efficient use of the machine's resources. From an educational point of view, however, a little more time creating user friendly features would enhance the programs educational value. Obscure machine codes meant the program couldn't be easily understood and operated by first time users. Software like this wasted student time in learning unnecessary commands. Teacher observations and student comments showed that Group 2 students in particular "gave up" as they found the save proceedure frustrating.

Process and Purpose

The role of the final assessment influenced students motivation to learning. If special purposes shape the processes of discovery and creativity then new innovations and compositions may depend on special purposes. This does not mean that the composing process is necessarily extrinsic or that music cannot be created for its own sake, rather that external constraints, personal goals, and

other motivational factors should be considered to gain a more complete picture of student learning processes.

A wide range of measures suggested that the final project had significant value in motivating some students. As a result of the impending deadline, several students came in to use workstations at lunchtime and after school. Group 3 demonstrated a significant improvement in their ability to resolve group conflicts and work together in weeks four and five. They concluded "we were good at working together under pressure and surviving the immature antics of others. We cooperated and pulled together in the end". This comment may also reflect the positive feelings of the group as a result of gaining the highest overall mark.

What is not so clear is whether all students perceived the presentation as a special purpose. Perhaps a less assessment orientated final would have yielded higher motivation for some groups. For example, Maori students may have been more comfortable in a aural, group evaluation. Playing students compositions on the school radio station, a take home tape, or a parents night could have led to quite different forms of motivation. A future research project might consider asking students for their suggestions of what the special purpose should be.

In this study the group composition was assessed in the final week of the programme. During this presentation the class, school principal and researcher graded the compositions. These grades are combined with an overall mark and bonus points to provide the final total (Table 4). Twenty-four students were present for the evaluation. Six students were away due to sickness, sports, or class visits. Of the twenty-four forms completed one student did not complete the form at all and four students completed rows for two or fewer groups. These results are not shown. A zero indicates students own group. Two lines without zeros are grades recorded by the school principal and teacher-researcher respectively.

Student	Rappers	Fireballs	FBI Crew	Rejects	Party Animals
1	61	42	0	65	53
2	56	52	0	58	63
3	56	45	0	51	70
4	47	34	0	38	23
5	54	0	76	56	56
6	0	76	89	80	73
7	0	59	60	40	40
8	70	64	88	61	0
9	0	80	93	74	66
10	60	70	56	0	43
11	69	69	85	68	0
12	63	58	66	0	49
13	64	60	80	55	0
14	41	45	64	26	0
15	18	78	88	0	65
16	39	36	45	0	54
17	71	56	0	56	64
18	87	80	79	0	66
19	49	55	0	74	64
20	76	65	76	58	78
21	59	58	79	60	85
Mean	61.2	59.1	74.9	57.5	59.5
Grade/50	27.8	26.9	34.1	26.1	27.1
Mark /60	50	47	48	46	46
Bonus	5	0	9	0	5
TOTAL %	69	62	76	60	65

Table 4: Composition Assessment Results

(Student mark out of 110)

4.3 Research context

In this section the composition results are briefly summarized. They are then examined more fully in relation to the other research intervention and evaluation measures. The final score shows groups 1 ('low Bentley'), 3 ('no musical experience'), and 5 ('social grouping') have the highest overall totals. During the final presentation these three groups demonstrated more positive interdependence, team spirit, task division, and previous planning. They also performed a more complex piece of music.

A breakdown of the above marks suggests the level of motivation and effort expended by the groups may be quite different. The bonus mark, for example, contributed significantly to the final total for groups 1, 3, and 5. The other two groups (i.e., 2 and 4) received no bonus as they did not use the workstations in their own time. Group 1 scored the highest mark out of sixty for cooperative group activities over the six week programme. How did this ability to work as a team aid the composition process? Process oriented questions like these are now considered.

Teacher Intervention

Initial concerns over student negative attitudes to school music and the resulting emphasis on student composition in a style of their own choice showed later benefits beyond the style with which the student was originally interested. The following comments by members of group 2 indicate that a widely based composition programme will have positive effects in motivating students towards other musical activities (c.f., Wiggins, 1989).

S2 Its got more choices (6)
S6 That's a change in music for me
T Why's that?
S6 I'm usually into 'rap'
T Did you enjoy it?
S6 Yep

The teacher's role in promoting thinking skills and social development involved supporting and enabling students and encouraging students to help and support one another. The role of guide was probably most apparent in the early stages of planning compositions. Initial pre-planning of ideas occurred on paper. Students also listened to ready made tunes and then experimented with speed, tempo, and rhythm changes to alter the tunes. The teacher modelled the editing of musical information and discussed musical outcomes with students. During conferencing students discussed strategies for solving problems.

The value of breaking compositions down into a series of small, achievable steps was first modelled by the teacher. Food names were divided into syllables and appropriate notation were added underneath. This idea was then transferred to student names. These rhythm compositions were to be performed later in the week on multi-percussion instruments. However, several groups demonstrated their rhythms, to the delight of the relieving teacher, the following day.

Other concerns related to group selection criteria (Table 3) examining students could be in two groups because of similar backgrounds. A high Bentley mark indicated that some students would perform composing tasks well. The competent pianists (most having a 'Hi' Bentley) facilitated composition and enabled recording. In contrast a 'Lo' Bentley did not indicate the students were unable to demonstrate the same kind of skills. Group 1 students gained the second to highest mark and demonstrated a great deal of resourcefulness in their approach to problem solving and composition.

Several students could have been placed in either group 4 or 5. Students in group 5, however, did much better at cooperative group and composition tasks. The deliberate placement of group 5 students with their friends appeared to contribute directly to the problem solving, positive communication and decision making that lay behind group composition. In contrast the personality conflicts that emerged in group 4 tended to stifle interaction and problem solving. Comparison of groups 4 and 1 is also instructive. The table shows Group 4 with the highest amount of music/computer experience and 1 had one of the lowest. Again the positive social relations that developed in group 1 appear to be a key factor in students learning off one another.

Table 3 also suggests that many students have had no previous musical or computer experience. As both of these categories require financial backing this trend seems to reflect the absence of upper-middle class and professional families in the school. In the researchers experience students entering the school who are gifted musically have often been denied access to computers or musical experience for financial reasons.

Conclusive comments can only be made however with a significantly longer period of testing than six weeks. The range of measures used must also be extended and used at different levels of schooling and homelife. If students are to be switched on to music and fall in love with composition the positive social approach to music education taken here must begin much earlier in the surrounding primary and intermediate schools. At present there is little evidence that this is occurring.

Types of Interaction

Several types of group interaction are noted from the intervention measures. An increase in dialogue, positive interdependence, and the ability to resolve conflict were most evident in groups 1 and 5. Several measures also record these groups as interacting more with peers and exchanging more information (see below). Group 5, in particular, demonstrated positive interdependence and involvement in all team roles by all members. Group members perception of other members social skills is in sharp contrast to other groups in which several students were not contributing (Appendix Fifteen : Social Skills of Other Members). Group 1 students said "we discussed things instead of leaving it to just one person". These results are supported in other measures which analyse group interdependence, social collaboration and interaction. Group 3 was characterised by off-task behaviour (see comments below').

T How well did you work together?(3)
S5 Its just sometimes Matthew was running back and forwards and calling us names (2) he goes and sits on me all the time=
S4 =*I did not!* (.) I was trying to beat you up=
S5 Gee wouldn't you run if you had somebody like that after you!

Group 3 also chattered and interacted with some intensity. The sheer volume of dialogue and ability to resolve conflict appears to have contributed to later success in their composition. The Group Skills (Appendix Sixteen) and Group Work sheets, recorded groups 1 and 5 with the highest number of ticks for 'always' accomplish goals, clarify problems, and feel good together. In contrast groups 2, 3, 4, recorded several 'never's. It seems likely that the positive interaction of group 5 is due to its strong friendship ties:-

T You said your group worked well together? Why do you think that happened?
S3 We just got on well together(.)
S6 For example everyone just got in and started playing=
S1 =And instead of one person being on it all the time you shared
S2 [pushed them out!]
S1 it around.

Another reason for their positive interaction and high marks according to these students is "our musical experience and background" Several had received private tuition. They demonstrated playing confidence and a willingness to take risks when using the equipment. The influence of their previous training was an advantage. The following conversation records how the influence of group structure and background contributed to their enjoyment and desire to explore. "Lets make up a song... Putting notes together on bars and that and then getting other bits and instruments and putting them all together to see what it sounds like".

One reason students in groups 1, 3 and 5 interacted more and exchanged information within the group appeared to be that one or more of the students came to the programme with a strong, positive experience with computers. Although they were not familiar with composition software it appears that their previous experience and enthusiasm was "caught" by other members. The various roles were not strictly adhered to by any group. For example, it was not

only the 'checker', but other group members who checked whether problems were solved. The fact that cooperative roles were redily swapped within a session appeared to be an advantage as students became more tolerant of others opinions and more deeply involved in decision making.

The high composition result of group 1 indicates that a low musical aptitude is not necessarily an accurate indicator of an individual or groups ability to compose or perform music. This is borne out in the experience of a wide range of itinerant music teachers (Bruce, 1990). It may therefore be unwise for the music teacher, parents or tutors to decide on a students suitability for a course of study or individual instrument solely on the Bentley test. Rather, a range of measures including student interest, perseverance and peer influence should be taken into account.

Metacognition and Dialogue Analysis

Conversations recorded in the teacher diary comparing the dialogue of group 3 (using Sonics) and group 2 (using Polywriter), revealed striking differences in the ability of the students to perform deeper processing and revision. The following conversation suggests that group 3 students engaged in more self evaluations, editing and revising of concepts than group 2 students. Both groups were working on card Composing 3 (a), : African Folk Song.

Group 3 - 'Sonics'

S1 Right, that's the last bit (i.e. track 2) done=

S2 =Give it to me (i.e., the mouse). What instrument shall we use (.) I like that one (5)

S4 Hey it changes (i.e., the snare drum part made the bar lines shift over in tracks one and two) um, huh=

S1 [Sneaky little thing]

S2 But it looks different. That isn't the right place for the bass beat, it should come a bit later...lets put in a rest to fix it up" =

S3 =Lets play it and make it go crazy!

S2 dupee dupee dubee do - it sounds O.K.

S1 Yeah, but no snare drum ha ha

S4 Where's it gone...?

At this point group 3 students had recorded three tracks including the rhythm track and were actively experimenting and comparing the screen information with what they heard to find out why they couldn't hear the rhythm track. This constant comparison of what they wanted with what they actually heard was also evidence of quite advanced music reading and theory skills.

The active involvement of the computer as "silent" partner is also evident in comments like "make it go crazy". Overall these students were quick to evaluate, revise, question and generally reflect on each others decisions. The kind of interaction recorded using dialogue analysis shows that student thought patterns were open to evaluation and questioning by other students. This climate of open questioning fostered musical exploration and helped develop revision and editing processes. In this way students were able to predict and question as they entered musical information into a sequenced passage.

Group 2 - 'Polywriter'

S5 Hey, now we can hear the second part, come on you're supposed to play!

S2 Just do it again (i.e., Debbie) =

S5 =Now how do I get back there (8)

S1 Dunno (3)

S2 This is boring (5)

S5 Here it comes, what does it say? I'm going to press it (i.e. the space bar)

S2 =2, 3, 4 (11) (Debbie now played in the second track)

S5 Now what? (7) It says to print (5). Hey its printing!

At this point most of the group seemed to loose interest and started talking about getting something from the cafe. It appears that limited interaction, poor problem solving skills and lack of previous computer experience also contributed to the shallow processing of group 2. The printed music had novelty value only. There was no comparison of what Debbie had played to what had been printed out. It was as if the group thought the recording and the printing of the notation were two unrelated, separate activities.

Revising of the music did not occur. Revision of written music may have also been difficult for these students as they appeared to have little understanding of standard musical notation. One consequence of this may be that deeper revision and processing of musical material for non-musicians is more direct and effective through the ear than the eye. If this is true track recording software like the D-20 will encourage aural revisions and re-recording.

While music may be becoming easier to produce it may not be getting any better. There's no substitute for the sweat and the hard labour of revision and refinement in composition. These systems allow the student composer to use the sweat to more beneficial ends. "One would hope that with the same amount of effort you could make a better product because you are not wasting so much time with the mechanical stuff that doesn't contribute to the creative process" (Vogel, 1987 p.2-1).

A fundamental problem exists for students without an inner means of pitching notes. This problem may be particularly acute for students without previous musical experience who have not acquired an ability to internally pitch intervals. For students in the study, matching sound to a visual symbol brought music out of a mysterious and theoretical realm, especially for the non-musician, and provided instant confirmation that the note symbols are merely tools for the practical manipulation of pitch and rhythm.

When asked if they were more positive at the end of the programme than the beginning one student responded, "Yes, I learnt to read music!" In view of this student's lack of previous musical experience it seems likely that it was the relationship between the notation and the sound that the student was referring to rather than a general music reading ability.

Deeper Processing

Students were encouraged to use the computer as a "musical scratch pad" (Stevens, 1990). By a cyclic process of doing, evaluating and re-doing, students were able to polish projects to highly refined states. In several cases the music was far more complicated than students could physically play. By saving their work on disk at each stage, students had the option of returning to earlier drafts and exploring a range of possibilities. Because of the ease with which alterations could be made, students were prepared to experiment and take risks. Encounters with false starts and dead ends became manageable parts of the process.

Students debugged rhythmic or melodic inaccuracies. Through repeated trials at recording an idea, and by analysing, isolating and reinserting musical elements into a coherent form (e.g. verse chorus, verse, chorus, bridge, chorus) they engaged in deeper processing of the musical elements. Students also synthesised independent instrumental parts and demonstrated their ability to arrange parts for composite groupings or ensembles.

As students engaged in this active, refining process they gradually sought out musical concepts and ideas for themselves. The teacher was frequently asked, "what do you call this .. in music", or, "how do you do such and such?" (e.g., create a repeated ostinato). Several students commented that it was easy to manipulate and alter information with computers and as a result they began working on their projects even if their ideas and concepts were only partially formed. The value of this initial exploration process is born out in several

different sets of results. Comments from the second interview with group 5 are cited:

S1 I thought you could never compose your own music if you didn't know music and that (.) the notes =

S2 Writing music just as it sounds (.) even if its higgildy piggildy (.) but its got a tune to it, a melody =

S1 Making it more original =

S3 You don't need the notes - *you just go doo doo doo!* =

S4 I feel sorry for you!

Individual's approached process composition in quite different ways. Several kinds of student problem solving were evident in the students books, during conversations, and while contributing to the group. Detailed, systematic working is contrasted with rough diagrams, discoveries and a flurry of ideas. Student's developed effective, systematic ways of planning that worked for them.

Similarly, some groups appeared to work best in a situation where they had detailed and ordered written plans. For example, they planned what had to be done, by steps, in a similar way to the worksheets. Other students scribbled down ideas as they occurred to them. While this spontaneous composing may appear haphazard it captured student insights and intuitions as they occurred.

Some students were "top-down planners". They began like Mozart, with the whole problem . They began with the whole problem and progressively analysed it into steps. Other students, like Beethoven, were "bottom-up planners" who began with the separate components and built up toward the final solution. This was particularly evident in students approach to sequencing longer musical passages. Students in a top-down fashion started with an overview of the piece by recording a rhythm track and planning the introduction and ending first. Others linked individual motives together until they sounded good. These

bottom-up planners tended to work on the separate elements of the piece and then found ways of bringing these together later on.

Equality and Mutuality

Groups tended to be similar in terms of equality but differed with respect to mutuality. Low to moderate levels of mutuality were observed because the students reached decisions by consensus. It appears that the process of group decision making within a cooperative framework may penalise the more able students. They feel obliged to compromise to a middle viewpoint for the sake of group harmony. This tendency towards a uniform mediocrity points to the need for greater individual accountability in this study. It may be a moot point - but the promotion of individual excellence seems a difficult goal within a totally cooperative framework.

Across all results levels of mutuality were strongest in groups 1 and 5 who maintained and developed high levels of discussion and positive interdependence. Group 2, in sharp contrast, exhibited very low levels of mutuality with individual students going off to do something else or showing sullen, moody behaviour. In the final evaluation group 4 commented we "did not take the work seriously enough" and "we needed to control our tempers". In contrast group 5 commented that they "enjoyed working together" and "liked to explore on the computers".

It was initially expected that group 4 would perform well because of their previous musical training. However it appears that they performed poorly because of several strong personalities and an inability to adapt to the creative potential of the technology (see the section on Previous Musical Training).

T You said your group did not work well together? Why do you think that happened?

S1 We got frustrated and that (.) its just that some people would sit and the other people would do the work. Someone would take over and not let anyone else have a go, but after a while we sort of got used to each other and then we started pitching in together. So it was all right. But when we started it was a bit haywire=

S2 We just sort of had to get our differences patched=

S3 We had different personalities=

S2 But we did cooperate in the end (2)

S4 After a while...

The reaction to group work sheet highlights these social and personality differences. Comments included - "Tim...is sort of bossy" and, "Tiff just sits in front of the screen and nobody else can get in." They appear to have begun working through personality differences towards the end of the programme. Successful cooperative learning approaches may take some groups much longer than six weeks to develop properly. In the intensive observation sheet the category 'asks for information' was particularly strong in groups 1, 3 and 5. An interesting contrast is that almost all members in group 4 gave a lot of 'direction'. Only two people actively participated in these two categories in group 2.

Group Performance and Attribution Theory

From the interview comments and teacher observations group 2 stands out as being low on equality. It appears to have had one leader and five rather submissive followers. This is borne out in the student comments:

T Do you think you cooperated as a group?

S4 It was Kate who did all the work=

S3 =When we did that project it was mostly Kate who did all the work, but we cooperated=

S5 *She's our leader!* (accompanied by group laughter)

The students in group two commented that they left the work to one person, that is the most able student (i.e., the competent pianist). They also appeared to reduce their effort to avoid being singled out or looking foolish. It seems that these students associated getting involved, or even opening their mouths, with failure. As a result participation and learning appear to have been inhibited. Rather than pool their efforts the group reduced mental effort and demonstrated 'loafing behaviour' (Salomon & Globerson, 1991 p.90).

The passive, teacher reliant nature of students in group 2 points to an underlying weakness of cooperative learning methods. These students, who were also low performers in the Bentley test and have few friends, seem to find cooperative groupwork threatening because their social and learning weaknesses are exposed. The fact that group 2 experienced limited social interaction and received a poor overall total seems closely related to its social isolates. It may be that socially low achieving students like these need to be eased into cooperative group activities much more slowly.

In terms of attribution theory low performing students in a cooperative group situation may be disadvantaged if their group is unsuccessful. Similarly the high performer who was left with all the work may also develop negative feelings. Preliminary evidence suggests that group failure can affect negatively the self-evaluations of a low performer (Ames, 1981). It appears from Ames' research that negative experiences in a cooperative learning group cause an erosion of self-esteem similar to that suffered by low performing students losing in a competitive environment. It may be that a group with a high proportion of low performers may significantly weaken the development of certain skills. Greater overall mindfulness, more revisions, planning, elaboration and summarizing may not occur (Salomon, 1991 p.90).

Musical Training

The dialogue, types of musical processing and final composition outcomes for students without previous musical training (i.e., group 3) and students with previous training (i.e., group 4) were quite different. Perhaps the clearest contrast was that Group 3 received the highest overall grade and group 4 the lowest. More importantly, however, the wide gap between the two results indicates significant interaction and learning differences.

Firstly, group 3 appeared to be able to make better use of the MIDI-enabled computers to write more complex music than did students in group 4. "We couldn't have done it without the computer ...It gave us the beginning and end sometimes and it helps you with the rhythm and that - gave us the sound." By using the MIDI-enabled computer to record and edit simple musical ideas it was not necessary to know musical theory or have mastered performance technique. It may be that working with an intelligent instrument has helped bridge a musical "knowledge gap" for students in group 3. Sheil comments, "It is almost true to say that we have entered the age where the complete dummy can manipulate sounds..without having to play a note" (1986 p.3)

Secondly, students who have received "training", in this case a formal classical training, seem to have been moulded in a certain way of thinking musically. A potentially open ended composition situation seems to have been turned into a closed and restricted situation by what these classically trained students preconceived musically. It appears that there is a tendency for such musicians to create musical forms which are copies of what they already know. One student was heard to say "I don't want to play my piece because its not as good (i.e. it doesn't demonstrate the same originality and vitality) as those other pieces. Overall it appears that students who have not had a previous musical training explore more and are prepared to take more risks than students who have had a previous training in music. One consequence of this may be that deeper

revision and processing of musical material for non-musicians is more direct and effective through the ear than the eye. Many musicians in the study also preferred the track recording sequencer to notation software.

Aural Listening Environment

Students in this study appeared to be more aurally aware of music than they were visually. Results across a wide variety of measures indicate that most students preferred the Intelligent Keyboards and D-20 sequencer as their favourite workstations. These keyboards offer little scope for editing of visual notation. They do offer extensive aural editing features. Observations suggest that students gained particular pleasure from recording sequences, and using arranger, rhythm features.

This observation may be significant for those music teachers who tend to let the visual side of reading and writing notation dominate their music programmes (Pegler, 1983). Whether one can go as far as Orams (1991) and say "notating music is a mechanical exercise not a musical one and much creative time is wasted in committing to paper the symbols representing the music" (p.2) is open to debate and further research. A subtle snare may be that one form of "time wasting" (p.6) can be easily replaced by another. Long lists of new commands, difficulties with typing, or a preponderance of technical instructions may be as onerous as the time taken to write out pages of manuscript. Previous research in the review section , suggests that a well rounded, balanced music programme should have a variety of composition approaches including pencil and paper notation.

When discussing composition and performance students from group 5 commented.."If you do it with another instrument and you write the notes down on paper you don't even know what you are doing ! - but on the computer it does it all for you (group laughter and agreement) and then you can play it and see what it all **sounds** like." These comments suggest the value placed on

listening as a skill within a balanced programme. Listening, however, appears to be taking second place to composing and performing in recent national curriculum initiatives. The support paper accompanying a recent draft of the school certificate music prescription lists the mark weighting per unit as:

	WEIGHTING
1. Individual performance	25%
2. Group performance	10%
3. Group participation	5%
4. Composition	20%
5. Listening	15%
6. Musical knowledge	25%

From: New Zealand Qualifications Authority.
Assessment and Certification Division Update 92/44S.
The Working Party section p.1

The above prescription relies heavily on individual teachers to organise and promote aural/listening activities that support performance and composition. Parsons (1983) suggests, one cannot go too far wrong as a music educator if the music programme is based in the music itself - that is, classroom listening, performing and creating activities begin and end with the sounds themselves.

Limitations of the Study

Initially, it was considered that if students rotated around the six workstations they would be able to explore and become familiar with four different composition systems. While students appeared to gain a working knowledge of several operating systems they did not receive more than three class sessions on any one workstation - unless they used the workstations in their own time.

Future research using one operating system for each group will lessen the problem of unfamiliarity with different systems and may increase the quality of time spent in revision and in polishing the music into its final form.

Results from the sociogram reveal that keyboard players of four of the groups each chose another keyboard player as their preferred seating partner. One would expect this to lead to wide ranging interaction and consultation between groups. However, a variety of measures showed groups tended to work together as a unit without sharing information with other groups. An implication of this may be that more time is required to directly teach the role of information gathering and inter-group consultation (i.e., the public relations role).

Lack of interaction between groups points to a general concern over the length of the study. In studies which focus on processes of learning with computers, a period of six weeks is often considered too short for viable results to be obtained. Further ethnographic research over a longer period of time may be needed to strengthen observations made or find alternative explanations. Studies of an experimental nature are needed to help focus on more specific learning outcomes.

CHAPTER SIX
CONCLUSION

The study explored how groups compose music with computers and the conditions under which such learning takes place. The role of the teacher in creating socially interactive and reflective learning environments was critical. Direct teaching of thinking skills and learning strategies, social interaction and peer learning provided the focus for intervention. If the goal was to empower students to become more effective and self-directed learners then the students needed to engage in composition in an active, social way similar to that undertaken while serving the apprenticeship for a craft.

If authentic composition activity can be symbolised as a pool, students barely got their feet wet. The craft knowledge and experience needed will develop over an extended period of time. The most significant conclusion is that the study was too short. Students exchanged ideas and modified their behaviour through conversations and narratives but as previously suggested further exploratory and experimental studies are needed. Consider the time needed for students to understand the composers craft within different periods of musical history. Following earlier discussion about style and authenticity - Palestrina's masses were written for performance in the reverberant acoustics of a church, the ornaments in Bach's Preludes and Fugues were intended for the Baroque harpsichord and the range of instruments found in the modern symphony orchestra or Heavy Metal Rock Band gives a vivid illustration of applied technology.

The study was able to confirm that musical composition is assisted by the use of the computer, student and teacher interacting together. The development of aural or listening skills may be particularly effective in this environment. Music can be programmed into a computer and altered to form a piece that is more advanced than the student would otherwise be able to play but if the context for human change is ignored these possibilities may not be fully realised. Several

factors influenced student composition. A variety of cultural, institutional, and motivational factors were evident. Social-emotional influences appear to be the key to understanding how students learn to compose music in a cooperative environment. Groups are social systems in which cognitive, motivational and behavioural processes need to be considered. Students in harmonious, cohesive groups with moderate levels of equality and mutuality gained the highest grades. Intergroup (rather than intra group) competition may have been a factor in inhibiting the interaction between groups.

How cooperative situations influence student's attributions is reasonably speculative, partly as a result of so little research in this area. The group outcome in a cooperative situation may be central to student's self-evaluations and interpersonal evaluations. In this study some of the positive consequences (e.g., positive self-esteem) attributed to cooperative learning situations may be more a function of the group outcome than the group structure.

Group structure influenced groups in a variety of ways. The combination of a musical background and warm social interaction in group 5 produced a desire to explore within a secure environment. Group 4 by the same token appeared to be disadvantaged by their previous musical training and negative social interaction. The low musical ability of group 1 did not effect the development of problem solving skills, and positive interdependence.

The process composition strategy was particularly effective in refining and developing germinal ideas. Composing music in an aural, symbol oriented culture appeared to be as effective or more effective than traditional pencil and paper techniques. This was particularly apparent for students without previous musical training. A lack of previous musical training was not a hindrance to musical composition using the computer. Rather the experienced musicians found that to their surprise, the efforts of the non-experienced were significantly impressive and more adventurous than their own. A broad based composition

programme appears to motivate students to explore other styles of music. Use of computer orientated workstations might be best used in conjunction with a number of other activities operating independently throughout the classroom. Performing and listening activities provide a necessary balance to a well rounded music programme.

Further research

This study is only a tentative first step in music education research. The aim of such research is not to produce definitive conclusions, but rather to provide emergent themes and evidence that might be used as reference material in the discussion of practice and as a basis for critique that may have relevance to other contexts (Stenhouse, 1985).

As discussed in chapter three the researcher could not, in practice, remain entirely 'outside' the research context. There are limits to such an approach. Emancipatory action research which is oriented towards improving practice through critical self-reflection comes part way to solving this dilemma (Carr and Kemmis, 1986 p.123). The practitioners as a group take responsibility for the development of practice without dismissing the implicit complexities. Such research may be useful in helping practitioners make decisions on the basis of a more self-critical awareness of their role, and the role of music composition in education. Several predictions are made for the future.

The process of invention and innovation in the development of education software/hardware may parallel that of the commercial sector, only several steps behind. In the words of Papert (1980), "Conservatism in the world of education has become a self-perpetuating social phenomenon". Cross fertilisation of ideas between commercial and educational sectors has led to some educational inadequacies in software being eradicated. While music teachers on the receiving end of commercially created software may count inherent software/hardware deficiencies (e.g., the use of programming language to access

or save data) as inevitable, some encouraging changes are forecast. Based on the scenario that educational software/hardware developments and applications tend to lag behind those in the commercial sector, some interesting predictions may be made.

A decrease in electrical equipment prices suggests students', particularly secondary school students', will increasingly use professional equipment to compose music. The same array of gear used by a growing gamut of professional musicians is becoming an integral part of a growing number of music classrooms. It may also be possible to predict future trends in use of educational composition software based on what is happening in the commercial market at present. Finally, if parallel developments do exist, a symbiotic interaction between educational and commercial-professional sectors may be hypothesized, and a clearer idea of the educational context for software development gained.

TWIN MYSTERY

To many people artists seem undisciplined and lawless
Such laziness, with such great gifts, seems little short of crime.
One mystery is how they make things so flawless;
Another, what they're doing with their energy and their time.

(From: Soundscape - Time p.56. 1975, Reed Education)

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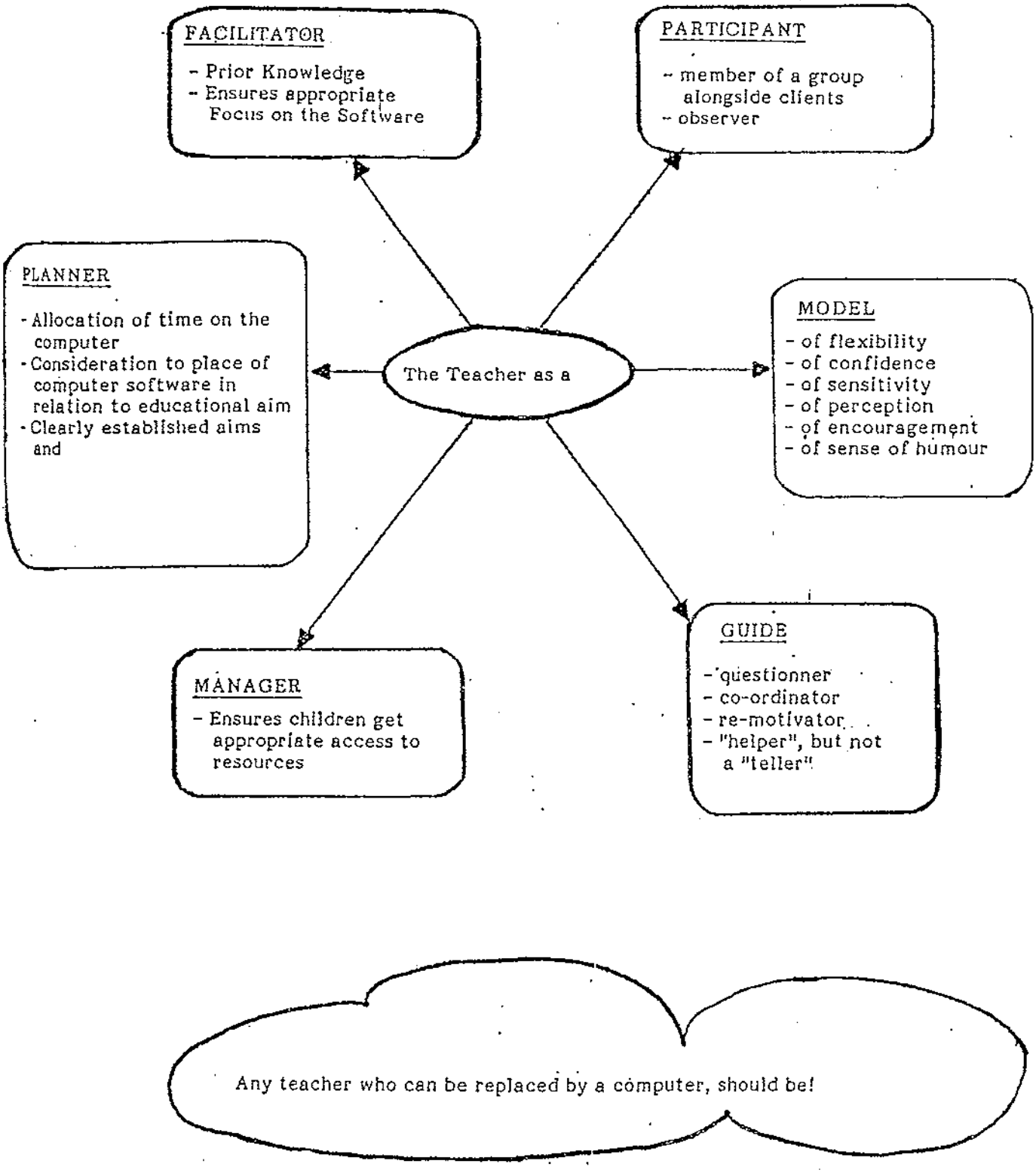
Appendix One

The Role of the Teacher

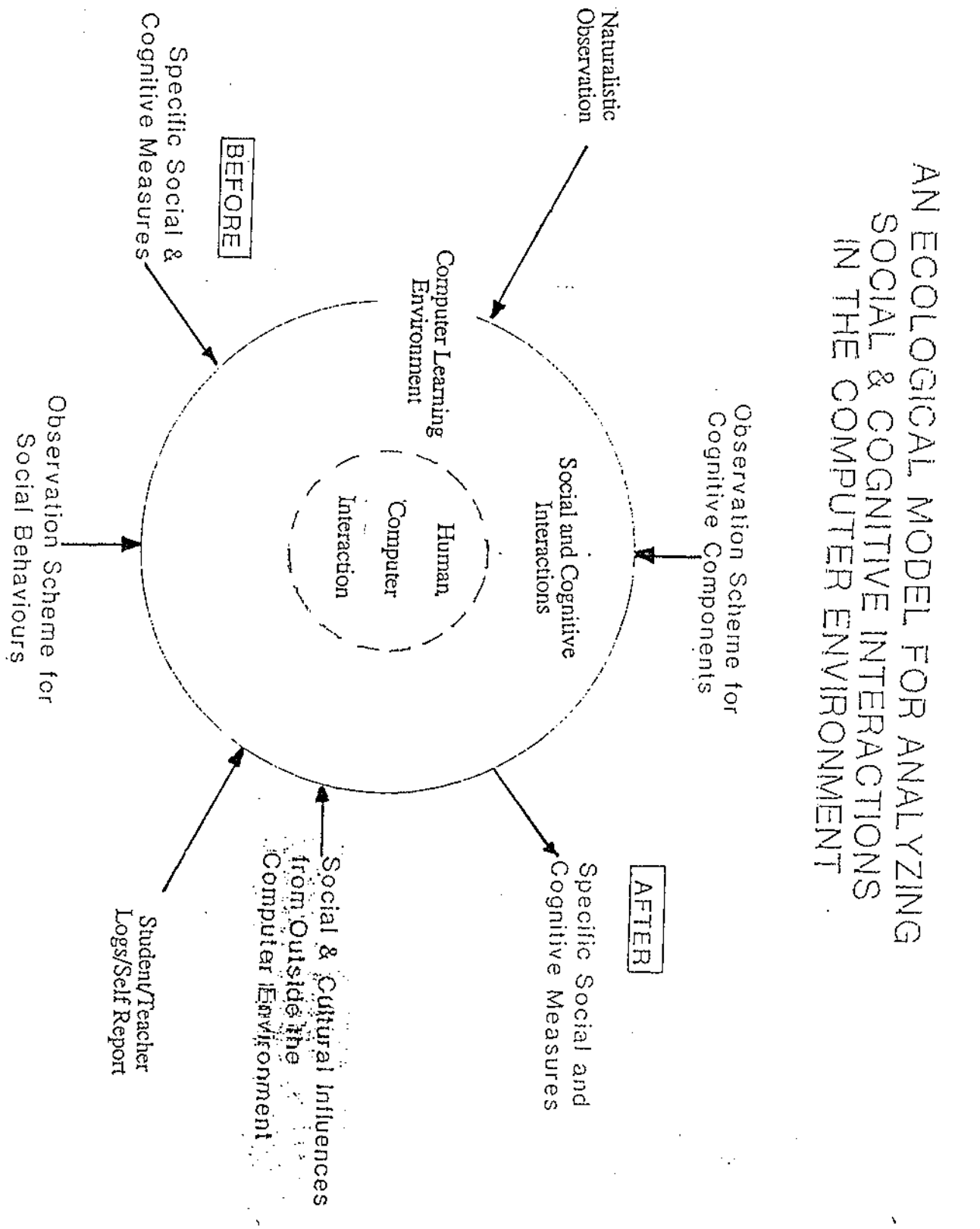


Adapted from: Computers in Education Development Unit (1987). *Interactive Fiction and Computers*. Wellington: Department of Education.

From, Computers In Education - 36.341
Learning With Computers:
Effective Teaching Strategies.
Study Guide 1. by,K.Ryba;B.Anderson

Appendix Two

An Ecological Model



From, Computers In Education - 36.341
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Appendix Three

Computer Culture Checklist

This checklist was adapted from Ryba and Anderson (1990) and used during the study to provide a basis for discussion during the informal evaluation sessions that the researcher undertook. It provides some of the questions that you might want to ask about the culture in which your students are using composition tools. Use it to help improve your classroom environment.

Composition Worksheets

1. Do the worksheets provide a logical sequence of music analysis steps, from the simple to the complex?
2. Do the activities encourage learners to explore music (e.g., find their own combinations of sounds, ask their own questions and find answers)?
3. Do the composition activities encourage students to plan their solutions systematically (step by step analysis of what they did and how they did it)?
4. Do the activitiies encourage students to think about their thinking (e.g., define the problem, plan a solution) before going on the computer?
5. Do the worksheets encourage students to try alternative sollutions to problems (e.g., arranging the data in different ways to arrive at the same anwser?)
6. Do the worksheets encuourage students to use systematic methods for locating and fixing mistakes (e.g., find all the occurrences of certain words)?
7. Do the worksheets encourage the students to breakdown complex problems into smaller and simpler problems (e.g., arrange categories, study results, define selection rules)?
8. Do the worksheets promote collaborative learning and shared problem solving?

Teacher Questioning

9. Do you provide individual consultations for the students to help guide them with their problem solving?

10. Do you provide training/instruction while at the same time encouraging students to think for themselves (e.g., trying out different ways of arranging data)?

11. Do you encourage students to break down complicated problems into smaller and simpler ones (e.g., "What is the first thing you need to do to solve this problem?")

12. Do you reinforce students for creating new ideas and solution strategies (e,g., verbal praise, class recognition)?

13. Do you provide meaningful positive reinforcement to students who engage in the use of problem solving processes (e.g., verbal praise, class recognition)?

14. Do you ask students to explain in their own words how they figured out their solution to the problems?

15. Do you encourage students to think up their own questions based on exploration of the data (e.g., "Can you think of some beginning questions that you might ask about this inforation?")

16. Do you encourage the students to apply the general information to non-composition stituations (e.g., How would you draw a sequence that describes what happens after you get up in the morning?)

17. Do you encourage students to be flexible thinkers (e.g., to compare and contrast different approaches to problem solving)?

18. Do you ask questions that clarify the problem (e.g., Tell me in you own words what you want to find out?")

19. Do you give time to students to answer the questions (e.g., Count to five first)

20. Do you ask follow up questions (Why do you think the sequencer played so unevenly)?

21. Do you encouarage students to summarize subsolutions into their own words as part of the answers (stating the problem for oneself often leads to a solution)?

22. Do you help students to become more fluent thinkers? Think of some other tunes you could build starting upon a different home note. What type of information would you need?)

23. Do you encourage studentsto synthesize subsolutions into a big solution (provide linking steps to move student from simply exploring the data to examining complex realtionships)?

24. Do you ask questions to encourage students to reflect on their own thinking (ask questions which lead to solutions without giving and answer)?

Socially Interactive and Reflective Environment

25. Do you keep your hands of the students' keyboard?

26. Do you encourage students to talk about what they did and how they did it?

27. DO you provide opportunities for learners to work on problems as a group, sharing ways of arriving at their solutions?

28. Do you have class activities that encourage individual students to explain their own thinking to other students?

29. Do you provide adequate time for students to pre-plan therir work off the computer (e,g,thing about how to arrange tracks and do independent track searches?

30. Do you provide adequate time for student to work out their solutions to activiities on the compueter?

PROCESS COMPOSITION: Two Examples

The Making of Hoopa Goora!!!

Hoopa Goora!!! was created by Ben. He had a Calypso melody from his guitar music book in mind as the basis of his composition. He keyed that melody in. Then, to provide an introduction, he placed an Irish Polka melody at the head. However, the story is not that simple. Ben worked fairly independently during the first session. In this account I attempt to piece together the process he went through. What is clear is that his inexperience with computers and music notation lead to some unexpected things.

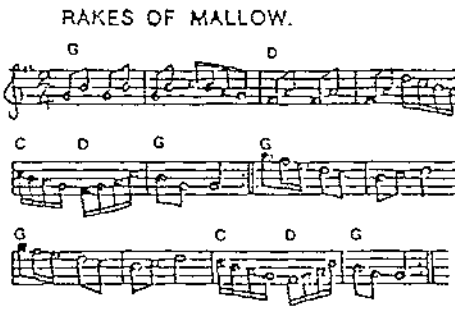


Fig 3. The original Irish Polka melody

The original melodies Ben worked from are given in figures 3 and 4. Both are in G major. They have different time signatures. Without being aware of the fact, Ben began writing with the stave set to C major, a time signature of 6/8 and a tempo of 90 crotchets per minute.

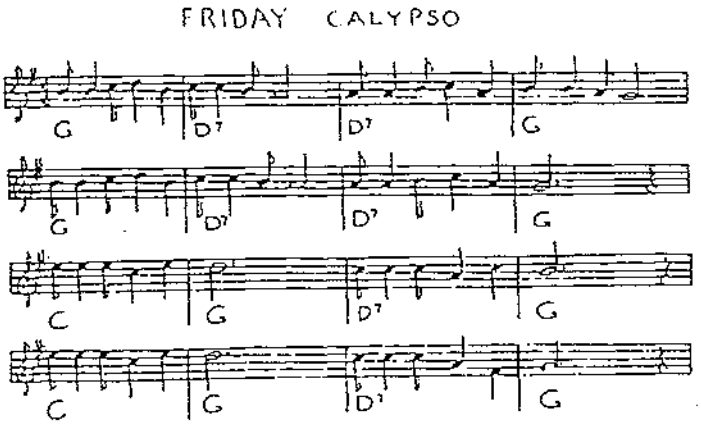


Fig 4. The original Calypso melody

First Ben entered the Calypso melody. He disregarded bar lines. He attention was focused on notes alone. He continued until he had entered the last note in bar 4 of the original. (See fig. 5). He played the piece from time to time as he entered the notes. He was unhappy with the tempo, so he eventually tried the piece at several others and settled on 120.

Fig. 5. The Calypso Melody, entered in 6/8 time.

He then began entry of the Polka at the head. He had a fast introduction in mind. The note values from the original score played too slowly, so he hit on the scheme of entering the notes as demisemiquavers to give a quicker play back. Thus the notes from bars 1 - 4 of the original were entered as demisemiquavers into his first bar. Notes from bars 5 - 8 were entered into his second bar. He repeated this process to create the third and fourth bars of his introduction. (See fig. 6).

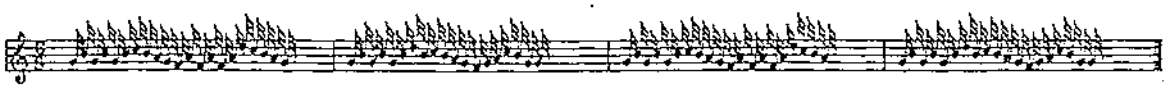


Fig. 6. The Polka Introduction, in 6/8 time and entered as demisemiquavers to "speed it up."

When he played back his work he was puzzled by unexpected "gaps" in his music. At this stage he called for assistance. Of course, each of his introductory bars lacks a few demisemiquavers. To aid Ben grasp the problem of the missing notes, the demisemiquavers were beamed. Some discussion about the missing notes occurred. The gaps were closed up by altering the time signature of the first four bars to 11/16. (See fig 7). Finally, at this stage, Ben decided that the introduction was too quick anyway. He reduced the tempo of that section to 60.

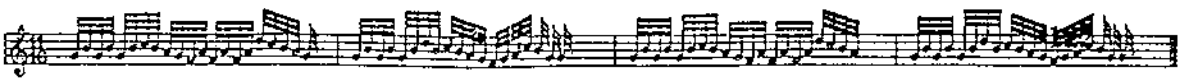


Fig. 7. The Polka introduction with the notes beamed and the time signature altered to 11/16.

When Ben began the task of entering notes in the bass stave, he soon called for assistance. His music teacher came to his aid. Together they tackled the task. The time signature problem re-emerged. This was repaired by setting the time signature of the Calypso part to 4/4 and rearranging the notes to fit that signature. The original score was not at hand. The resulting melody is thus a variation of the original. The notes in the bass stave were then added. (See fig. 8).

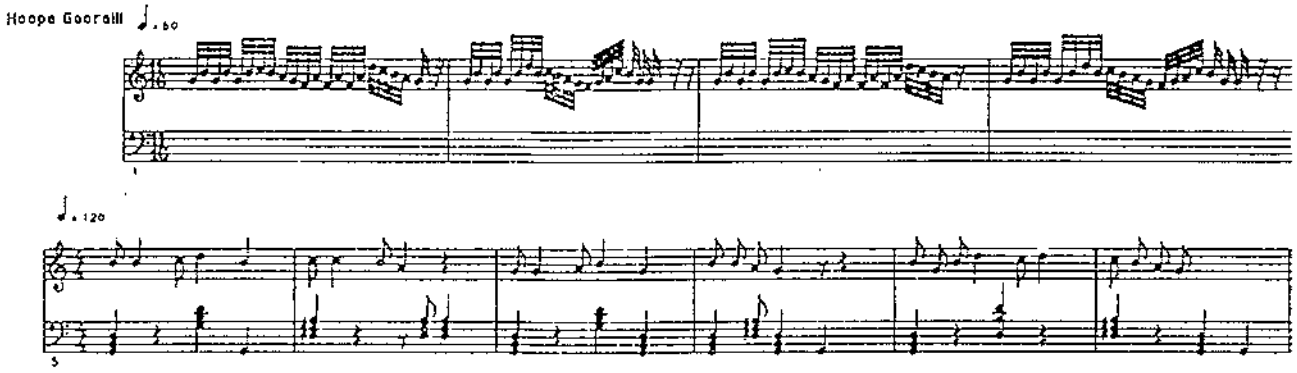


Fig. 8. Hoopa Goora!!! with the base harmony added.

At his request, towards the end of the final session, Ben's computer was attached to the Drum Machine. He wanted to add a percussion part in the short time remaining. He first attempted to place a percussion introduction before the Polka, but got into a tangle. He scrapped that and called for assistance again from his music teacher. Together they added the pattern that appears on the third stave. (Fig. 9). Please refer to the chart on page 22 for the relationship between the pitch of the notes on this stave and the voices produced by the drum machine. Ben and his teacher worked with a similar chart.

Ben's efforts extended over three work sessions. He worked independently at the computer to key in the melody lines. He called for assistance as problems arose. He received considerable assistance with the entry of the harmony and rhythm lines. Through inexperience he made several blunders. In the process of recovering from them, his grasp of musical concepts developed. Towards the end he expressed the wish that he could discontinue work on this first effort at composition and start again. I hope he gets the chance.

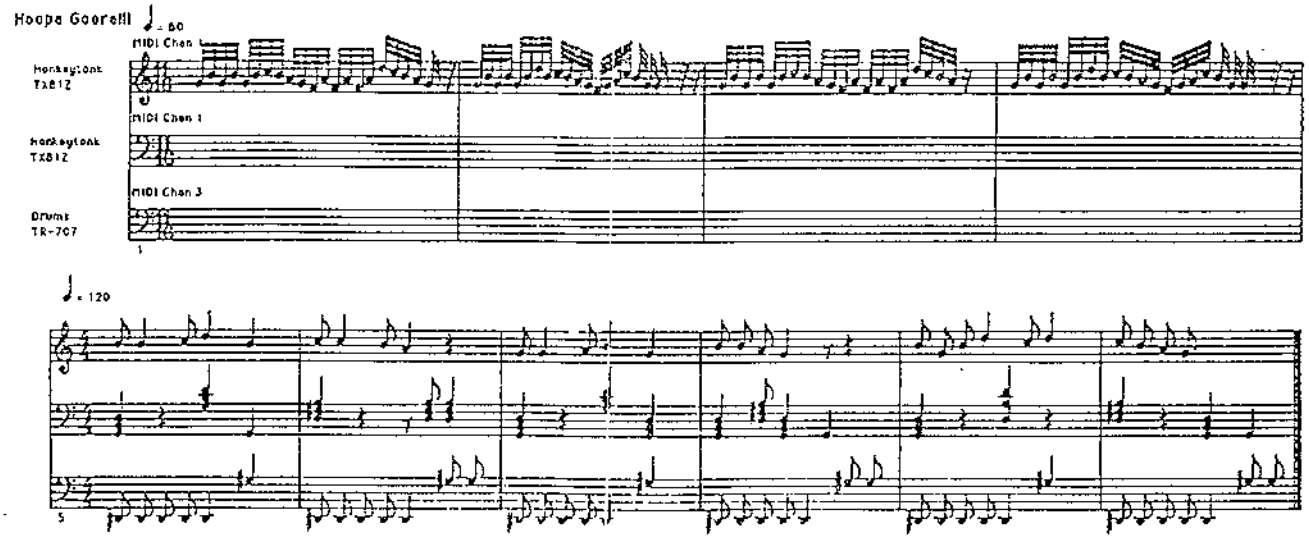
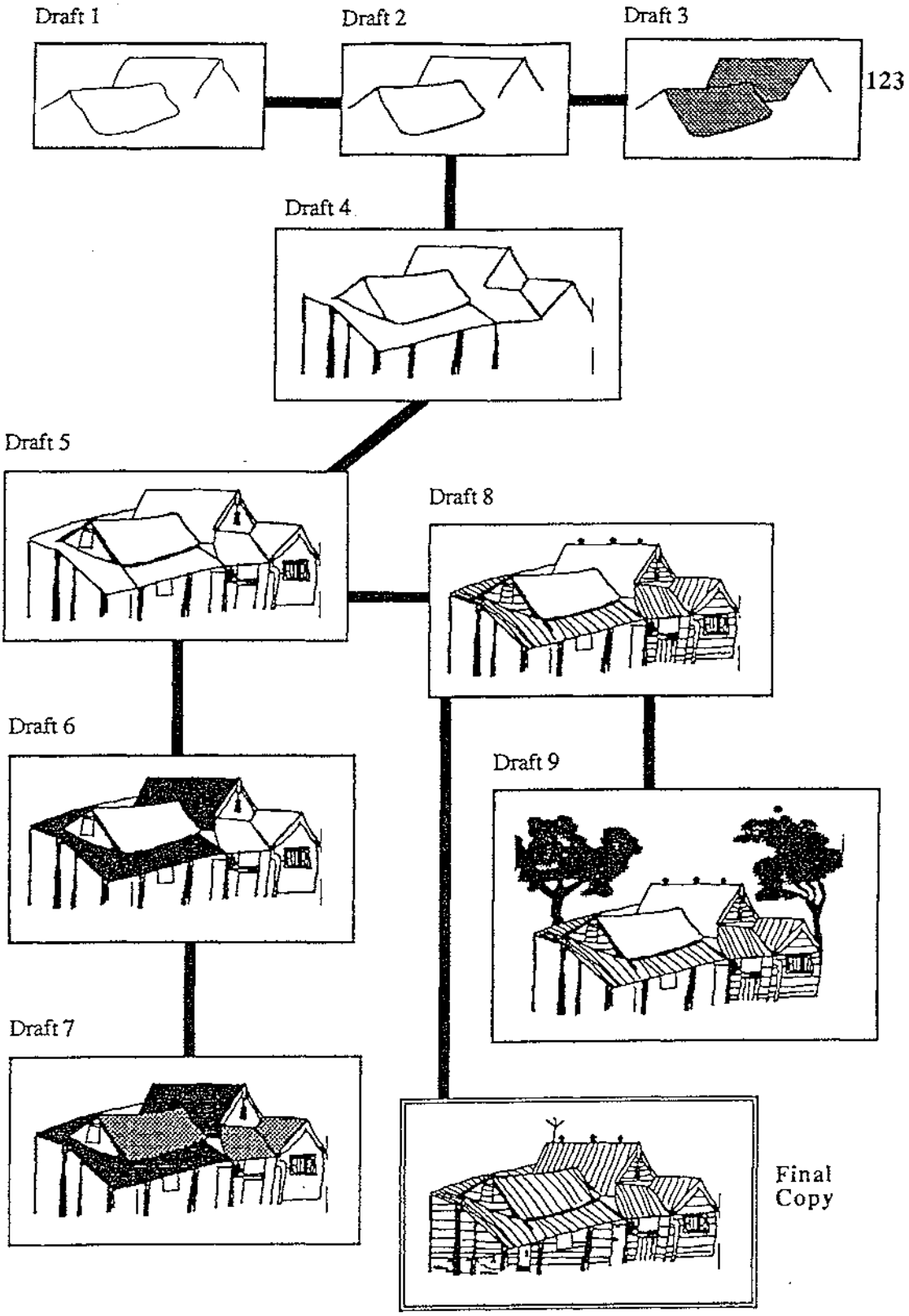


Fig. 9. Finally a percussion part was added.

SCHOOL SKETCH



The process by which Kelly, a grade six student, used a computer to create the final copy of a sketch of her school is clearly portrayed in the above layout. Note that on three occasions she rejected drafts with unwanted effects and returned to an earlier stage to continue.

Both "Hoopa Goora" and "School sketch" used with permission of Michael Gallagher. Found in"COMPOSITION and ARRANGEMENT" by children from Flora Hill Primary School by, Michael Gallagher

An Examination of the Place of MIDI instruments and Computer Composition Programs in the Music Curriculum.

Loddon Campaspe Mallee

Computer Education Centre

December 1987

Appendix Five

Electronic Music Glossary

ANALOG: Capable of exhibiting continuous electrical fluctuations which correspond in a one-to-one fashion to the audio input or output; the opposite of digital.

DEDICATED SEQUENCER: A synthesizer/module specializing in one particular aspect of the recording/playback process. Usually a stand-alone unit.

DIGITAL: Digital equipment uses microprocessors to store and retrieve information about sound in a binary form. Digital microprocessors typically divide potentially continuous fluctuations in value (eg amplitude) into discrete, quantized steps. The opposite of analog.

DRUM MACHINE: Programable hardware/software that has all the characteristics of an acoustic drum kit along with editing and recording features.

INTERFACE: The place where two things come together. Two instruments are said to be interfaced when their operations are linked electronically.

KEYBOARD: A piano-like controller used primarily for playing traditional melodic and harmonic patterns. Usually the sounds cannot be altered electronically or programed. Compare to synthesizer.

MULTI-TIMBRAL: Capable of generating notes using two or more patches at the same time. The simplest are those with a split keyboard feature, while in the more complex each voice can be assigned its own tone colour.

QUANTIZATION: The process of adjusting a continuous input so as to produce a output in discrete steps. Ryhthmic quantization is also called auto-correct.

SAMPLE: A digitally recorded and stored representation of a sound. Also, a single word of data that makes up a portion of such a recording.

SAMPLER: A keyboard or rack-mount module that records and plays back digital representations of acoustic sounds.

SEQUENCER: A digital recording device. With comprehensive editing facilities. Usually found in conjunction with a recording clock, which determines the rate of playback.

SOUND MODULE: A hardware device, either physically separate or integrated into a larger unit, which is designed to make some particular contribution to the process of creating sound. (e.g., a piano module has a wide range of acoustic, electric, and sampled piano-like sounds). Modules may specialise in a particular type of sound or function. For example, a String module, or, an Effects unit.

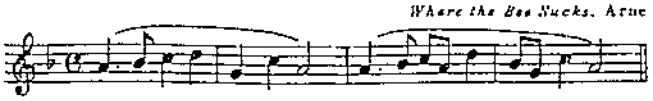
SYNTHESIZER: a programable keyboard with a variety of digital and analog sounds (this depends on the brand). A synthesiser is usually more expensive than a keyboard and is MIDI equipped.

Appendix Six

Music Terms and Concepts

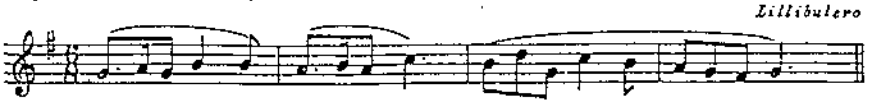
Decoration The repeated phrase is varied or decorated in some way.

Where the Bee Sucks, Arne



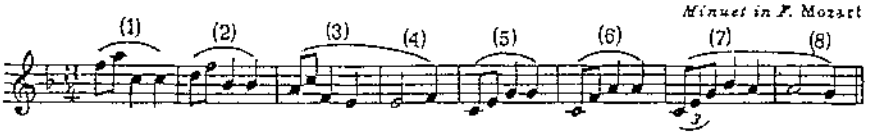
Sequence A phrase is repeated immediately at a higher or lower pitch.

Lillibulero



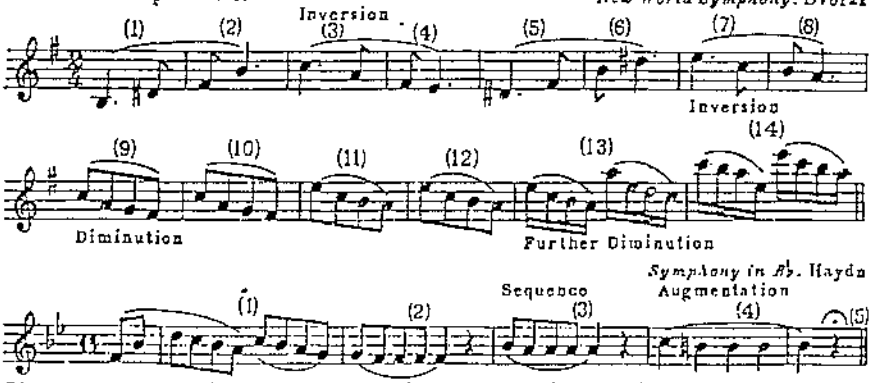
Rhythmic development A phrase often splits up into smaller sections, and then the same rhythm is often repeated with variations of pitch. In the following example there are no exact sequences, as the intervals are different at each repetition. But the whole eight bars is rhythmically developed from the first bar.

Minuet in F, Mozart



Inversion, augmentation and diminution Sometimes a phrase returns with the intervals falling where they rose before, and vice versa (*inversion*). Or it is contracted rhythmically by playing the notes more quickly (*diminution*), or expanded by making the notes longer (*augmentation*). These kind of devices occur frequently in contrapuntal music by composers such as Bach. But they occur surprisingly often in more modern music, or even in simple tunes.

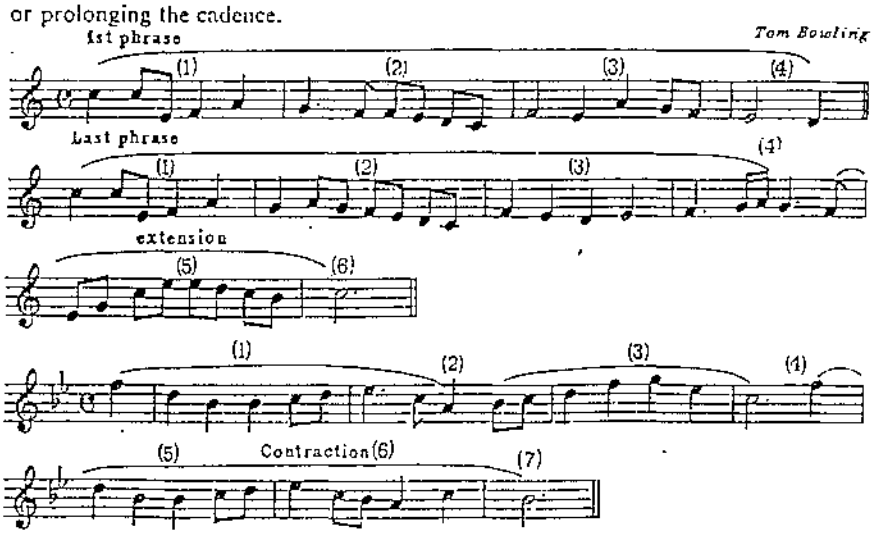
New World Symphony, Dvorak



Symphony in B♭, Haydn

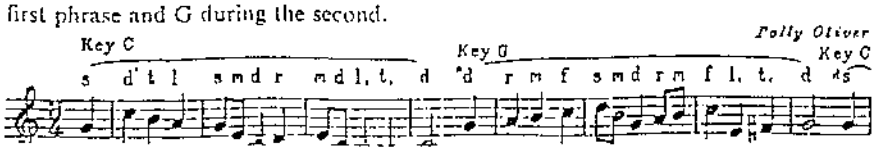
Phrase extension and contraction Sometimes a phrase is made longer or shorter than the rest of the phrases in a tune by extending or contracting it in some way. It is particularly common for the final phrase of a tune to be extended, perhaps by repeating or prolonging the cadence.

Tom Bowling



When music changes key during the course of a piece the result is called *modulation*. If you listen to the following tune, which begins and ends in key C, you will realise that it is not in the key of C at the end of the second phrase: it has modulated to the key of G. You will notice that there is an F♯ in place of an F, so that, in the second phrase, the tune is using the notes of the key of G, and not C. But the essential thing to realise is that the musical centre of gravity has shifted—the tonic is C during the first phrase and G during the second.

Polly Oliver



Choice of voice:

adult, child or in between;
high (soprano, treble; tenor), low (alto, contralto; bass) or middle range (mezzo-soprano; baritone);
light-coloured, dark, sweet, harsh or nasal (and so on);
single voice, small group, choir

Choice of instrument:

classroom or orchestral according to ability of players;
string, woodwind, brass, percussion, keyboard, guitar;
played in normal way or perhaps with mute or plucked

Tempo:

slow, fast, moderate or any other speed (but remember to be practical, as some players may not be able to play just the speed you would like);
show speed with Italian terms, in your own language or with metronome marks (remember changes in speed during a piece, like slowing down)

Dynamics:

very soft to very loud;
show with initial of Italian words (*f* means *forte* or loud), or in your own language (although this is often clumsy);
show changes of loudness with words or with hairpins ( )

Articulation:

smooth, joined sound (legato) – leave unmarked or show with slurs;
broken, detached, spiky sound (staccato) – show with dots, above or below the notes, or if it is to carry on for a long time mark staccato

Transposition -

when a piece of music is completely raised or lowered into a higher or lower key, it is said to be transposed.

Retrograde Inversion -

is to play the a piece of music backwards and upside down (see above).

Canon -

two or more parts play the same tune throughout, one after another. If the l bars of a canon are made to fit with the first bars it is possible to return to th beginning and go 'round' again. This kind of canon is called a round.

Form -

a piece of music is said to be Binary if it divides into two parts (i.e., A. B). I Ternary form the A section is heard again after B and usually in the original key.

Twelve-note composition

(after Schoenberg) all twelve notes of the chromatic scale are treated as equal This row may be subjected to various types of distortion such as inversion or retrograde motion, but the sequence it has established governs the regulation the notes throughout the piece, at whatever pitch they appear.

Pentatonic -

a scale of five notes missing the fourth and seventh degrees. Characteristic of much Asian and Chinese music.

Learning Together - Initial Game

The purpose of the initial game was to encourage students to communicate and reach decisions as a team. It created a situation where the students had to physically cooperate to implement a plan of action. Asking students to mix and communicate with each other in a close physical way highlighted a number of group characteristics which recurred later in the programme.

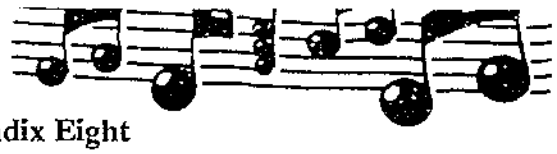
Groups 1 and 3 quickly got organised and practised their carrying positions. They communicated effectively and demonstrated task interdependence in picking up cards. They also shared leadership while carrying the sick person and opening doors. Group 4 argued over what they were going to do and didn't reach any consensus decisions. They took the easy way out and cheated. Group 5 were very stand offish and a barrier between the males and females arose as a result of the close physical contact required. Group 2 stood around looking at each other or stayed in their seats until the next group shouted at them to hurry up because they were in the way and wouldn't be able to start on time. Group 2 lost or were unable to collect all the get well cards, dropped their sick person and struggled to communicate directions.

"Contagious Disease"

RULES: Each group must be together (i.e. touching) on exit and entry to the music room. This room is safe. The only way you can catch the disease is by breaking contact with your group outside the music room. You must remain where you first broke contact. If you break contact and catch the disease you may be "cured" by somebody of the following group (or the teacher) touching you.
Groups were given a mark for each of the following goals:-

Goal One - To move the contagious person between each of the workstations without touching the ground. (Reward : 1 mark)
Penalty : If the contagious person touches the ground the whole group must star again

Goal Two - The contagious person must pick up a yellow 'cure card', from each workstation, without touching the ground. (Reward : 1 mark for a set of five cards)
Penalty : Loss of half a mark for every missing card.



FOR EACH QUESTION PLEASE TICK ONE BOX ONLY.

QUESTION ONE

Choose one word to describe the way you feel about music (generally):-

- ☐ Couldn't live without it
- ☐ Enthusiastic
- ☐ Interested
- ☐ Boring

QUESTION TWO

I would describe my attitude to school music as :-

- ☐ Couldn't live without it
- ☐ Enthusiastic
- ☐ Interested
- ☐ Boring

QUESTION THREE

If your attitude to 'music in general' is different from 'school music' please say why?

QUESTION FOUR

What do you like most about school music?

QUESTION FIVE

What do you like least about school music?

QUESTION SIX

Please tick a box which best describes what you think 'composing music' will be like-

- ☐ dull & boring
- ☐ hard work
- ☐ enjoyable
- ☐ exciting

QUESTION SEVEN

Please tick the sentence that best describes what you think 'composing music' means-

- ☐ writing words about music
- ☐ drawing lots of music notes
- ☐ creating tunes
- ☐ making music with instruments/voices
- ☐ experimenting with sounds
- ☐ making up your own songs and pieces

QUESTION EIGHT

Do you find the idea of composing music on computers is:-

- ☐ dull & boring
- ☐ hard work
- ☐ enjoyable
- ☐ exciting

QUESTION NINE

- ☐ I have never used a computer.
- ☐ I have used a computer for -
  - ☐ Word processing (writing)
  - ☐ Games
  - ☐ Graphics (pictures)
  - ☐ Music

  } You may tick more than one box.

- ☐ I did not enjoy using it
- ☐ I enjoyed using it?

QUESTION TEN

Give the number of times you have sung in a singing group or sung solo for an audience

- ☐ Never
- ☐ Once
- ☐ Less than five times
- ☐ More than five times

QUESTION ELEVEN

What musical instrument can you play

Give the total time spent learning. Years_____Months_____

QUESTION TWELVE

What can other members of your family play? Please name instrume

---

QUESTION THIRTEEN

Do you still play :-

- ☐ Regularly
- ☐ Occasionally
- ☐ Seldom
- ☐ Never

QUESTION FOURTEEN

Do you still have lessons

- ☐ Regularly
- ☐ Occasionally
- ☐ Seldom
- ☐ Never

QUESTION FIFTEEN

Give the grade of any musical exams passed.

- ☐ Practical
- ☐ Theory

QUESTION SIXTEEN.

If you had the chance to sit beside one person who would be your FIRST choice?:- (In this class).

If you had the chance to sit beside one other person who would be your SECOND choice?:-

---

THE TEACHER WILL FILL IN THE FOLLOWING

____ BENTLEY

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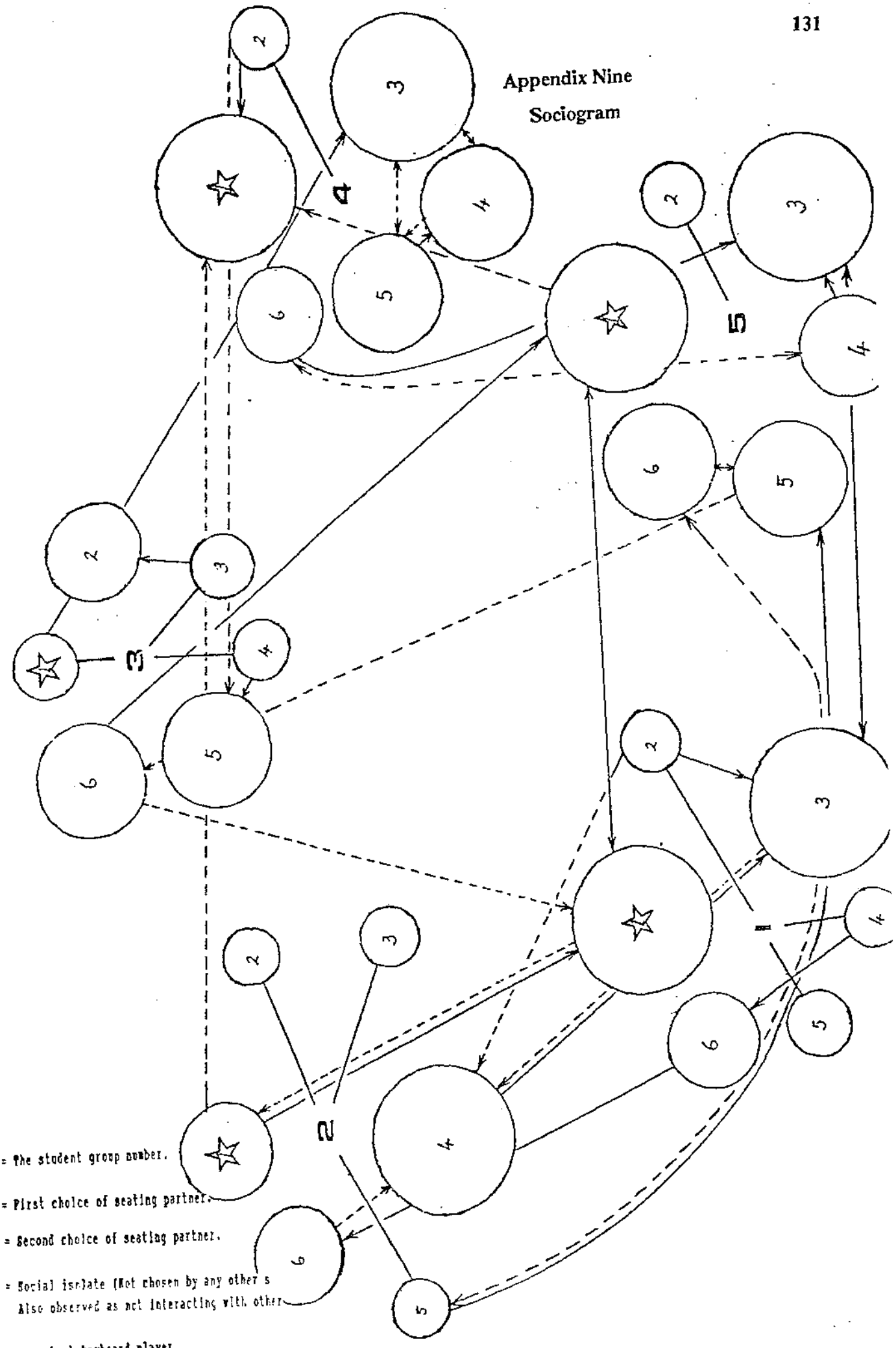
Appendix Nine

Sociogram



KEY:

= The student group number.

= First choice of seating partner.

= Second choice of seating partner.

= Social isolate (Not chosen by any other s
Also observed as not interacting with other

= Competent keyboard player.

Name..... School.....

Sex..... Age:.....years.....months. Class..... Date.....

I II III IV

PITCH

1	
2	
3	
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6	
7	
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11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

TUNES

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4	
5	
6	
7	
8	
9	
10	

CHORDS

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2	
3	
4	
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20	

RHYTHM

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3	
4	
5	
6	
7	
8	
9	
10	

Total Score .....

TABLE II. PITCH DISCRIMINATION TEST—PITCH DIFFERENCES USED

Item	Direction of movement	Difference as fraction of a semitone	Difference in c.p.s.	First sound c.p.s.	Second sound c.p.s.
1	Down	1	26	440	414
2	Up	1	26	440	466
3	Up	¼	18	440	458
4	Down	¼	18	440	422
5	Up	½	12	440	452
6	Down	½	12	440	428
7	Down	c. 5/13	10	440	430
8	Up	c. 5/13	10	440	450
9	Same	—	—	440	440
10	Up	c. 4/13	8	440	448
11	Down	c. 4/13	8	440	432
12	Up	c. 3/13	6	440	446
13	Down	c. 3/13	6	440	434
14	Down	c. 5/26	5	440	435
15	Up	c. 5/26	5	440	445
16	Same	—	—	440	440
17	Up	c. 2/13	4	440	444
18	Down	c. 2/13	4	440	436
19	Down	c. 3/26	3	440	437
20	Up	c. 3/26	3	440	443

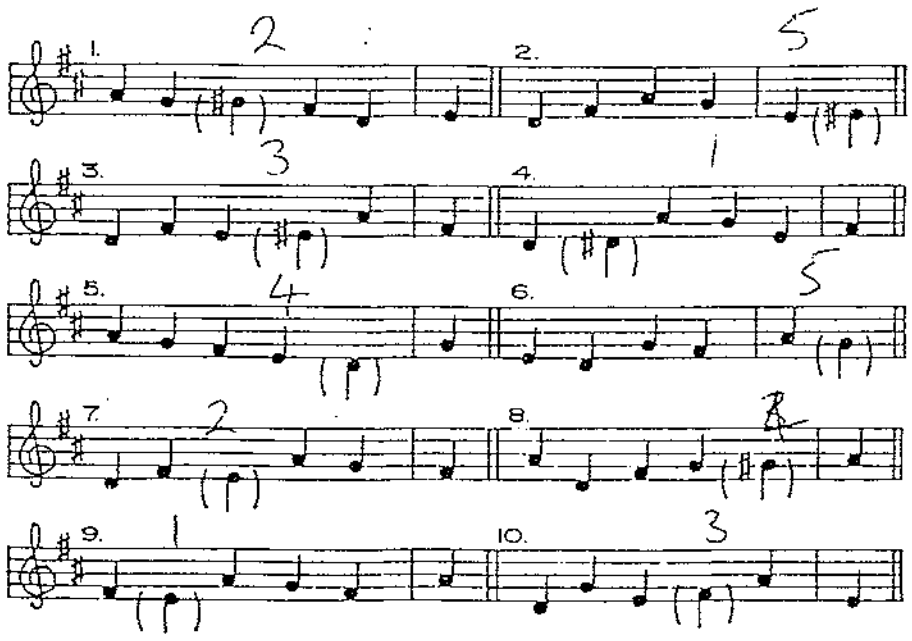
(1)

"Bentley Musical Ability Test"

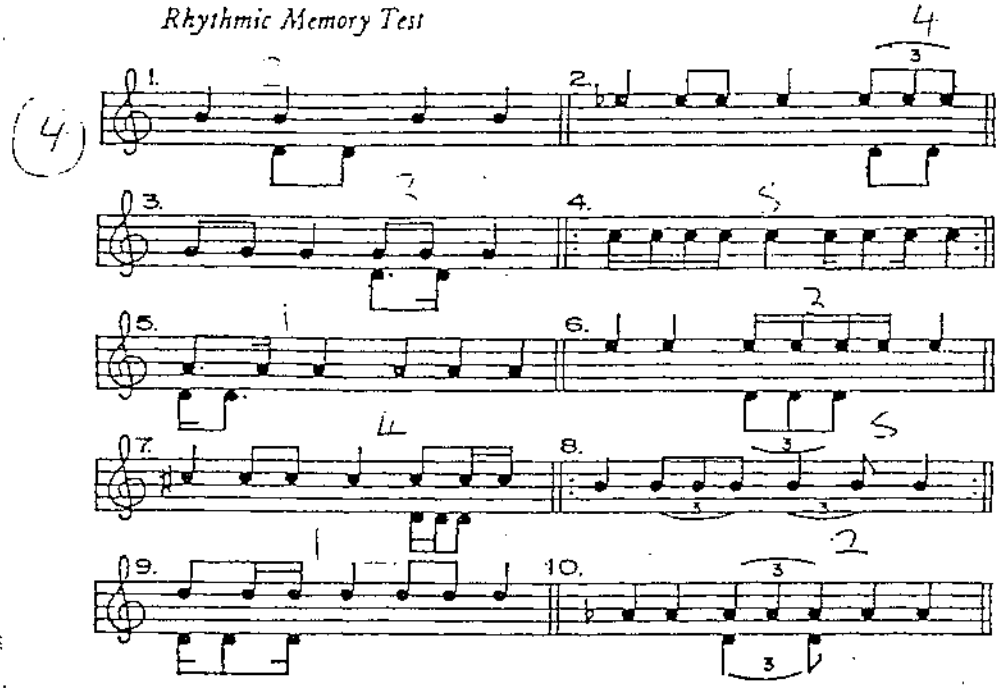
ITEMS OF THE TONAL MEMORY, RHYTHMIC MEMORY, AND CHORD ANALYSIS TESTS

Tonal Memory Test

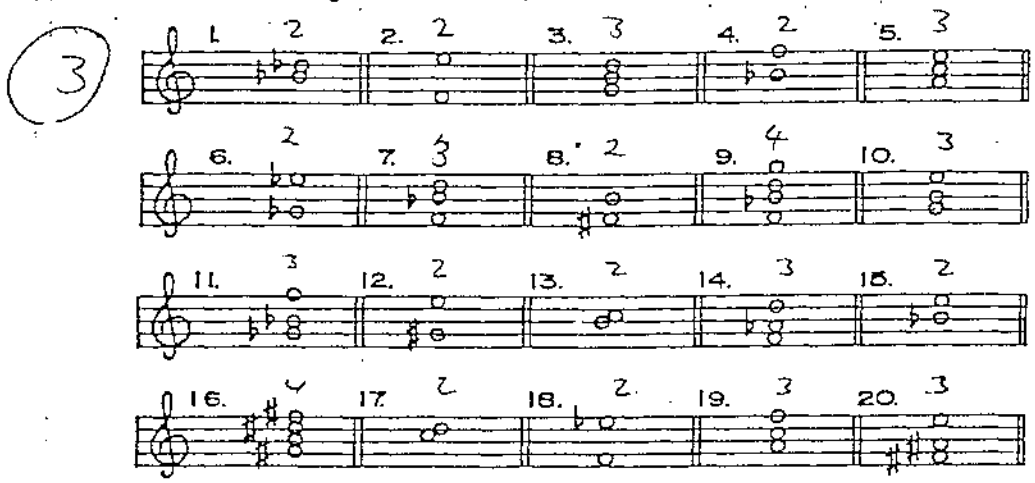
(2)



Rhythmic Memory Test



Chord Analysis Test



AGE

13

RAW SCORE	%	RAW SCORE	%
0	0	31	25
1	0	32	29
2	0	33	31
3	0	34	35
4	0	35	40
5	0	36	42
6	0	37	46
7	0	38	51
8	0	39	55
9	0	40	59
10	0	41	63
11	0	42	67
12	0	43	70
13	1	44	75
14	1	45	77
15	2	46	82
16	2	47	86
17	2	48	89
18	2	49	91
19	3	50	94
20	3	51	95
21	4	52	98
22	6	53	98
23	6	54	99
24	7	55	100
25	8	56	100
26	11	57	100
27	12	58	100
28	16	59	100
29	19	60	100
30	22		

M = 37.74

S.D. = 8.86

AGE

14

RAW SCORE	%	RAW SCORE	%
0	0	31	19
1	0	32	22
2	0	33	25
3	0	34	29
4	0	35	34
5	0	36	38
6	0	37	43
7	0	38	48
8	0	39	51
9	0	40	55
10	0	41	60
11	0	42	66
12	0	43	70
13	0	44	76
14	1	45	82
15	1	46	86
16	1	47	89
17	1	48	91
18	2	49	93
19	2	50	94
20	3	51	96
21	4	52	96
22	4	53	97
23	5	54	98
24	7	55	99
25	7	56	100
26	8	57	100
27	11	58	100
28	13	59	100
29	14	60	100
30	16		

M = 38.53

S.D. = 8.19

Appendix Eleven

Music Department Questionnaire 136

NAME.....CLASS.....AGE...YRS..MTHS...DATE../../

NOW ANSWER THESE QUESTIONS;

1. Write your address.....Phone No.....

2. Underline the word that best describes your attitude to music:
   COULDN'T LIVE WITHOUT IT; INTERESTED; NEUTRAL; BORING; UGH !

3. What sort of music do you prefer?.....

4. What radio station(s) do you most regularly listen to?.....

5. Who is your favourite singer? .....

6. Who is your favourite instrumentalist?.....

7. What is your favourite group or combination?.....

8. Name the best record you own.....

9. Name any concert you have really enjoyed.....

10. What musical instruments can you play? .....

11. Give total time spent learning.....

12. Do you still play REGULARLY, OCCASIONALLY, SELDOM, NEVER? (Underline)

13. Do you still have lessons?.....Exams passed.....Theory.....

14. What can other members of your family play? (Specify).....

    .....

15. Would you like to learn an instrument at school? (Underline)
    VIOLIN; VIOLA; CELLO; DOUBLE BASS; FLUTE; OBOE; CLARINET; TRUMPET.

    Write down any other you would like to learn.....

16. Which of these school groups would you like to take part in?
    CHOIR; FOLK CHOIR; FOLK INSTRUMENTAL GROUP; ORCHESTRA; MAORI GRO

17. Name any instrument you own or could borrow.....

18. Name any instrument you could lend to the School .....

19. Name any sort of music you actively dislike.....

20. Would you like to take MUSIC as a SCHOOL CERT . subject?.....

21. How many times have you sat the BENTLY TEST before this?.....

22. If so, what was your best total?.....Grade gained?.....

23. Where was the test given?.....Teacher's name.....

Criticising and comparing performances enables us to improve our own performance, by identifying weaknesses and strengths in oursel and others.

AIMS:

1. To explain the role of criticism and how it can be applied.

2. To identify factors which affect critical judgement.

3. To examine the problems peculiar to self criticism

4. To break down the process of criticism into single component parts which can then be used to refine techniques of self-asses ment.

CRITERIA FOR MEASURING THE RELIABILITY OF CRITICISM.

1. Familiarity with work or style
2. Knowledge of historical factors that affect sound quality.
3. Knowledge of instrumental techniques.
4. Familiarity with the style of a performer.
5. The mood of the listener
6. The context of the performance.

ASPECTS FOR WHICH TO LISTEN:

!. Immediate gut reaction - what kind of response
2. Is it stylistically/musically satisfying?
3. Is it accurate? (Tempo, Tune, Dynamics, Pitch, Timbre etc)
4. Is it rhythmic?
5 Is it'committed'?

ASPECTS TO OBSERVE:

1. Introduction -what is it we are about to hear? Who is performir
2. Do we know anything about the performer and the works
3. How well is the information presented? Is it verbal or written?
4. Stage presentation and prepartion
5. Acoustics - audience response
6. Deportment and entrance and exit of performer, acknowledging
7. Attire and seating or positioning of instrument and stand
8 Playing from memory or not
9 Relationship to accompanist or other players
10 Lighting

ENSEMBLE PERFORMANCE:

!. Is it balanced? together?
2. Is it colourful and varied?
3. Is there a sense of performance in presentation?
4. Is it well shaped and phrased?
5. Are their technical skills adequate for the performance?

These aspects apply to all music performances, regardless of the difficulty or style of music.

Appendix Thirteen

Interview Coding Numbers; & Programme Evaluation

KEY:-

(1.5)	means a pause with the length in seconds given by the number in brackets;
(.)	means the pause was too short to be easily measured;
get real!	Italics mean considerable stress was placed on the word;
=	these signs are used to indicate the conversation was carried on without discernable break;
[ ]	text bracketed occurs simultaneously;
( )	parentheses indicate a portion of inaudible speech;
T1	indicates the teacher;
1 - 6	are the students in the group being recorded.

Programme Evaluation:-

1. Name your groups favorite workstation. Say why you liked it?
2. Which TWO tracks (Melody, Bass, Chords, Rhythm) would you like to spend more time on? Why?
3. Name one thing your group did well together?
4. Name one thing your group did not do well together?
5. How could you improve your composition and cooperation next time?

Appendix Fourteen

Intensive Observation Sheet

Observation Sheet : Intensive Observation

ACTIONS	ROGER	EDYTHE	HELEN	FRANK
ENCOURAGES OTHERS TO PARTICIPATE				
EXPLAINING CONCEPTS AND PRINCIPLES				
EXPRESSES SUPPORT				
GIVES DIRECTION				
ASKS FOR INFORMATION, RATIONALE				
PARAPHRASES				

FROM: Cooperative Learning and Computers. An Activity guide for teachers. In Chapter 3: General Lesson Design Principles for Three Cooperative Learning Strategies - by, Male, Johnson, Johnson, &Anderson

Appendix Fifteen

Social Skills of Other Members

						TOTAL
1. CONTRIBUTES IDEAS						
2. DESCRIBES FEELINGS						
3. PARAPHRASES						
4. EXPRESSES SUPPORT, ACCEPTANCE						
5. EXPRESSES WARMTH, LIKING						
6. ENCOURAGES OTHERS TO CONTRIBUTE						
7. SUMMARIZES						
8. RELIEVES TENSION BY JOKING						
9. GIVES DIRECTION TO GROUP'S WORK						
10. CRITICIZES IDEAS, NOT PEOPLE						
11. DIFFERENTIATES AND/OR INTEGRATES IDEAS						
TOTALS						

FROM: Cooperative Learning and Computers. An Activity guide for teachers. In Chapter 3: General Lesson Design Principles for Three Cooperative Learning Strategies - by, Male, Johnson, Johnson, &Anderson

Directions for use: Students in each group were asked to put the names of their group members across the top of the page. They were then asked to give every other person a mark out of ten for each of the eleven categories. These marks were totalled by the researcher.

Appendix Sixteen

Group Skills Sheet

			
1. How carefully did we check?			
2. Did we help each other?			
3. Did we encourage each other?			
4. Did we finish our work?			
5. How well did we teach?			

What was your group good at?

Comments  ta da 

Group Members Sign

FROM: Cooperative Learning and Computers. An Activity guide for teachers. In Chapter 3: General Lesson Design Principles for Three Cooperative Learning Strategies - by, Male, Johnson, Johnson, &Anderson.

Appendix Seventeen

Reaction to Group Work Sheet

The first two sections, 'goals' and 'roles', were processed as a template by placing all sheets on top of an OHP and counting the ticks in each column.

1. So far as a group , we: —

	ALWAYS	SOMETIMES	NEVER
1. accomplish our goals	_____	_____	_____
2. help each other add or clear up ideas	_____	_____	_____
3. feel good about working together	_____	_____	_____

2. As a group member I acted as an (a) -

		MOSTLY	A LITTLE	NONE
1. ENCOURAGER	1	_____	_____	_____
2. RECORDER and READER	2.	_____	_____	_____
3. CHECKER - asks, have we completed todays GOAL, goes over CHECKLIST, clarifies ideas.	3.	_____	_____	_____
4. MATERIALS ORGANISER	4.	_____	_____	_____
5. PUBLIC RELATIONS gets ideas and help from other groups.	5.	_____	_____	_____

3. - Something that I did to make the group feel better about working together: _____

- Something that I did to make the group more successful in doing its work: _____

- Something that I'll work on next time: _____

_____

4. Other group members who:-

1. Encouraged others _____
2. Kept records or read _____
3. Checked understanding or clarified ideas _____
4. Organise materials _____
5. Got ideas and help from other groups. _____
6. Were very quiet _____

FROM: Cooperative Learning and Computers. An Activity guide for teachers. In Chapter 3: General Lesson Design Principles for Three Cooperative Learning Strategies - by, Male, Johnson, Johnson, &Anderson

Appendix Eighteen

Musical Motives - 'A Good Idea'; developing it, an example

All you need to compose yourself is one small idea !

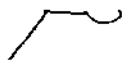
Musical composition, like painting, writing, or designing starts with an idea. One idea leads to another and then to another and so on. Sometimes the first idea is left behind because you find a better idea. Sometimes the original idea gets changed around or made longer. Look at the the card 'Making an idea grow'.

Some ideas come from your mood or feelings. Often the occasion for which the music is to be written will spark off an idea. Is the music for dancing? for relaxing? for welcoming important visitors? for a background to a video or scene in a play? Deep down inside you there are thousands of ideas like these. Your job is to capture them on paper or tape.

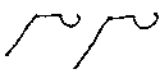
Most musical pieces are made up of a small number of ideas. It is what the composer does with these ideas which makes a composition dull or interesting.

A MOTIVE or MOTIF is a short but interesting RHYTHMIC or MELODIC idea which can appear throughout a musical composition in a variety of shapes or styles, yet still remain recognisable. Motives can be made to grow, can be shrunk or can change their shape - in fact almost anything that the composer wishes. Their function is to hold together or UNIFY the composition.

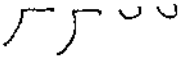
Some ways in which motives can be changed are:



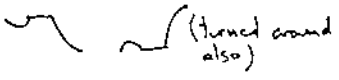
1. By repetition.



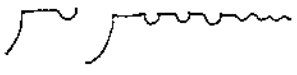
2. By dividing into parts & repetition



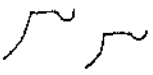
3. By turning upside down. (INVERSION)



4. By repeating with variation.



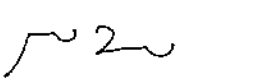
5. By repeating higher or lower. (SEQUENCE)



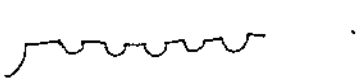
6. By stretching the intervals.

7. By shrinking the intervals.

8. By changing in some other way.



9. By extending.



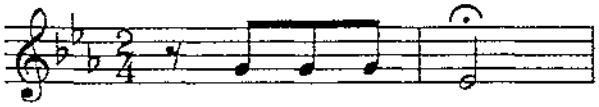
10. By organic growth - each part gives rise to the next.

DEVELOPING A MUSICAL IDEA

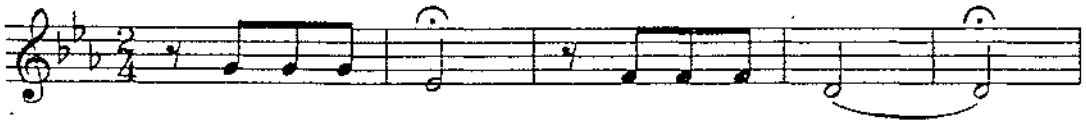
A composer must take the properties of sound and mold them into musical ideas. A very short musical idea is sometimes called a motif. Motifs may be combined into musical themes.

Below is a very simple melodic motif. One of the most famous compositions of all time was developed from this motif. Play it on bells or piano to find out whether anyone in the class recognizes it.

- How many different pitches are used in the motif? What are their names? How many individual tones are in the motif?



Here is the first theme of this composition. How did the composer build this theme from the motif above?



Build your own musical motifs. You may wish to work with one or two people. Proceed in this way:

1. Select two or three resonator bells (or piano keys) with which to make up a motif. Have no more than six tones (including repeated pitches) in your motif.
2. Play your motif several times; then write it on music paper.
3. Build your motif into a theme by using some kind of repetition. Try several possibilities. Play your theme.
4. Select two themes that have been built as suggested. Use them to create a short composition. In order to do this, you will need to decide the following:
   - Which will you use for theme I and which for theme II?
   - How many times will each theme be heard?
   - In what different ways might each theme be used or played?
   - How will the composition begin and end? Will it have an introduction and/or a coda (special added ending)?
   - What will make the composition unified?
5. Develop your composition. You may need to make some kind of score to help you remember your themes and the order in which they are played.

Writing a good tune:-

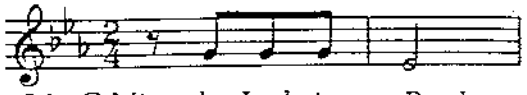
Think about the tunes you have been using in the last couple of weeks and other tunes you think are good. Growing tunes need 'sap' for strength and nourishment. Use this 'SAPP' model to write a good tune of your own.

SKETCH out, sing, or play a MOTIF
ADD notes to make the 'motif grow
PHRASE your tune so it has a shape
PERFORM to others. You may want to record.

Ludwig van Beethoven
(1770-1827)

Listening

Symphony No. 5 in C Minor, First Movement—Exposition, Development, Recapitulation
Ludwig van Beethoven

This motif  is the basis for Symphony No. 5 in C Minor by Ludwig van Beethoven. The rhythm of the motif ("short, short, short, long") is heard throughout the symphony.

A **symphony** is an extended composition for orchestra, consisting of several movements (large sections). Each movement has its own form or structure.

The first movement of a symphony is usually in a three-part form, called **sonata-allegro form** (the form of the first movement). The three parts are as follows:

Exposition—The "exposure" of the musical ideas upon which the composition will be built. The main theme is presented. A bridge theme then moves the music into a new key and the presentation of a second theme. The exposition usually ends with a **codetta** (little coda, or ending).

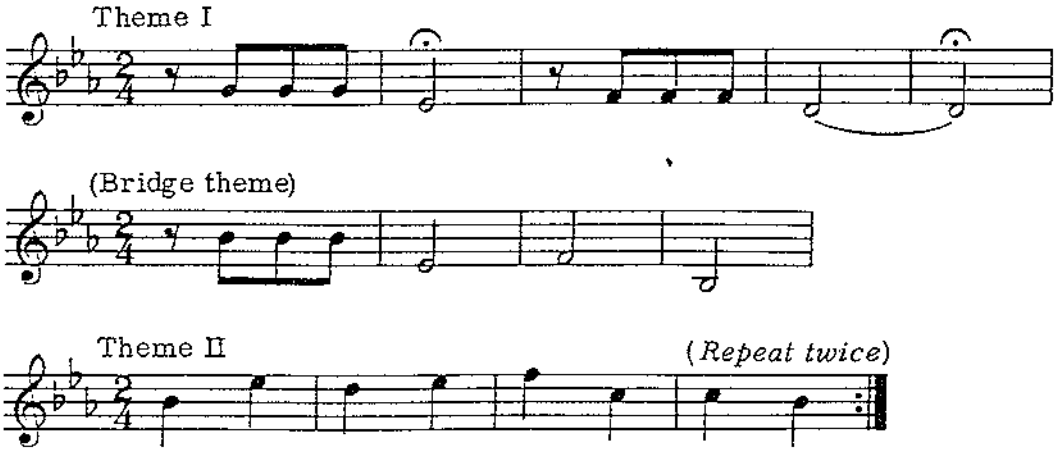
Development—The musical ideas which have been exposed are now developed by various compositional devices.

Recapitulation—A "recap," or repeat of the exposition, with some changes in instruments and keys. The order of themes remains the same as in the exposition. The recapitulation is usually followed by a coda.

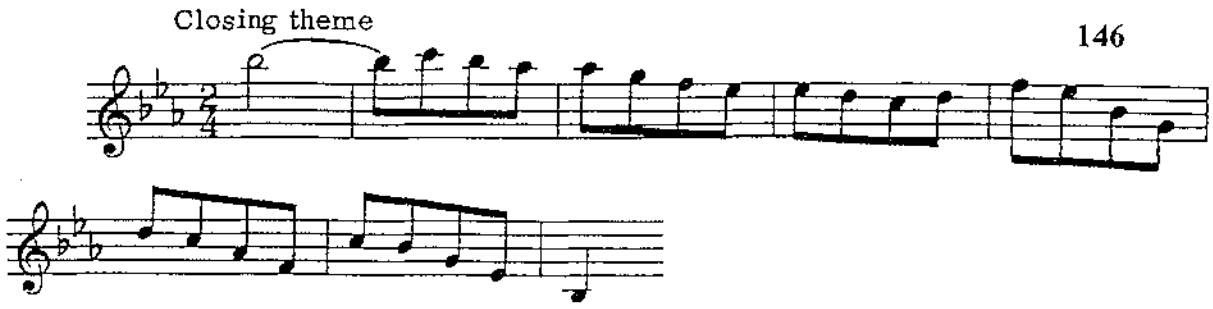
Beethoven's Fifth Symphony

The Exposition

Play and sing these four themes several times. Then listen for them in the exposition section of this movement of Symphony No. 5.



Listen again to the exposition to hear examples of sequence, inversion, and exact repetition. Listen also for the codetta after the closing theme. Notice how frequently the "important" themes (I and II) are repeated, often by different instruments, and in various pitch ranges.

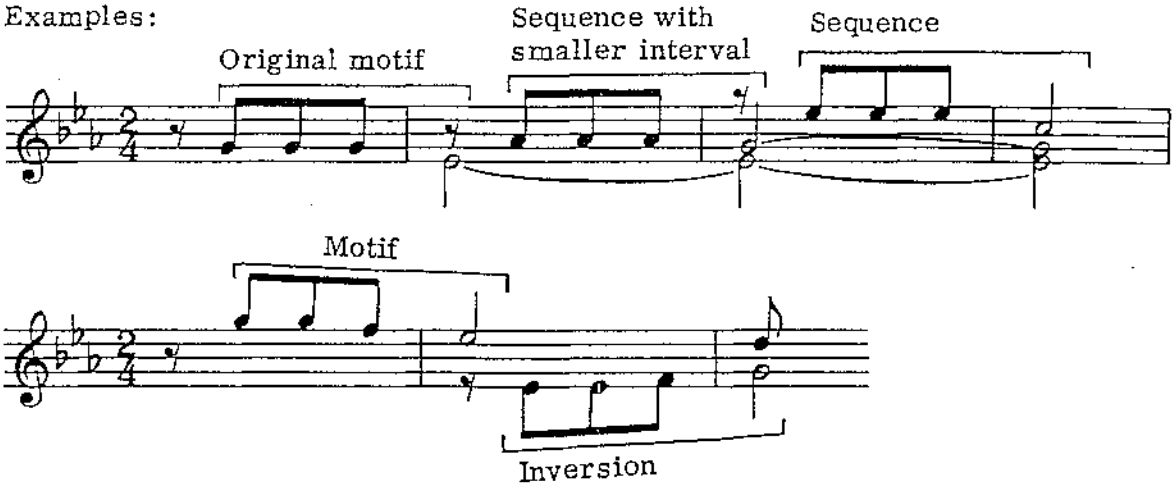


Before listening to the exposition again, notice how cleverly Beethoven built his first theme after its initial presentation. Here are two compositional devices he used:

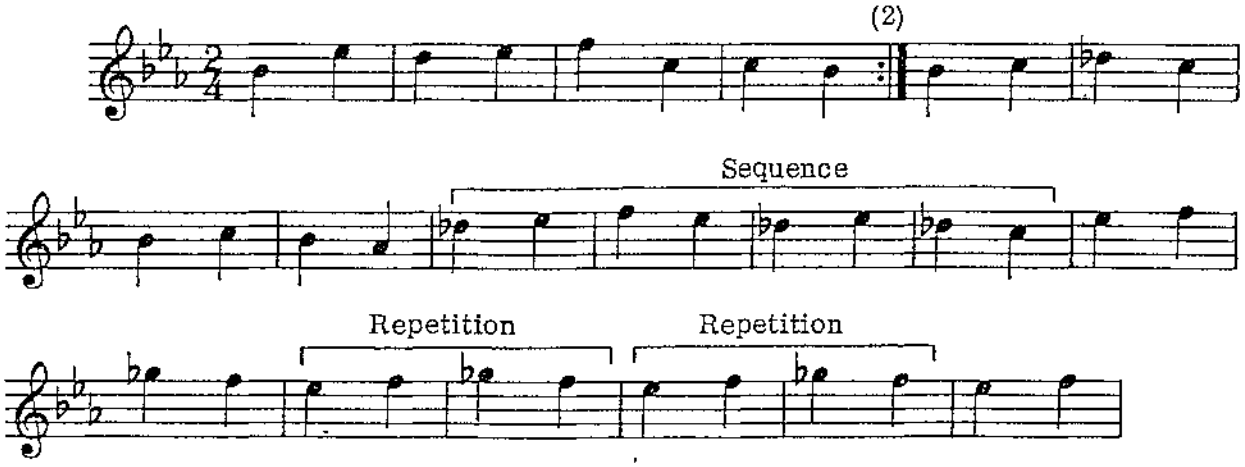
Sequence—repetition of a melodic pattern at different pitch levels
Inversion—intervals turned upside down

Note that the original four-note rhythm pattern remains the same.

Examples:



Beethoven used sequence and exact repetition in theme II.

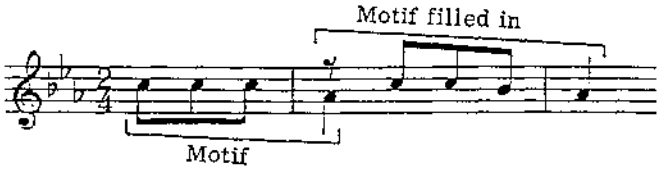


The Development

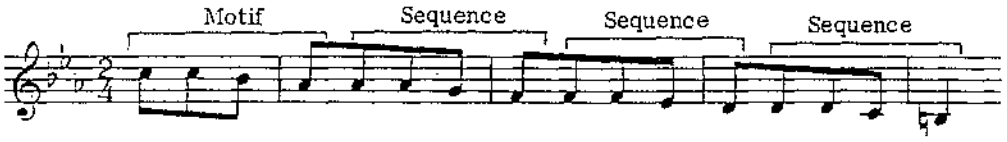
Now that you have heard the exposition, listen to the development section of this symphony to discover:

- Which theme is developed most fully.
- How development is accomplished.

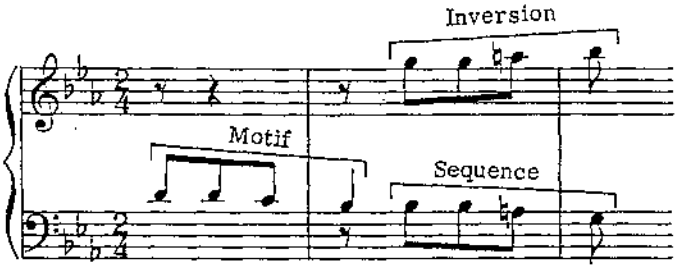
1. Motifs with intervals filled in



2. Repetition by sequence

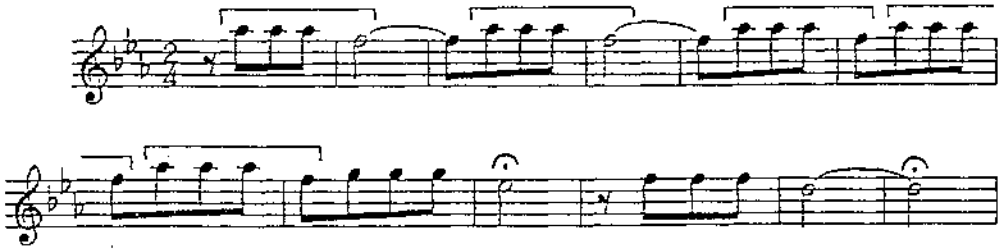


3. Inversion



4. Simple repetition
5. Themes given to various instruments

The development section ends with a passage containing exact repetition, leading into a very loud restatement of theme I; the composer has now brought the music back to the original key in order to begin the recapitulation. Find theme I as you play the notation below.



The Recapitulation

The recapitulation has begun, and the themes of the exposition are being heard again. There is a surprise, however, when an oboe melody that has not been heard before changes the mood of the music. The restatement then continues, using themes I and II, and the closing theme and codetta of the exposition. Powerful chords that sound very final make you think the composition is at an end, only to be overlapped by the beginning of an extended coda.

As you listen to the development and recapitulation, identify:

1. The fortissimo (very loud) chords (theme I) that mark the end of the development section and the beginning of the recapitulation.
2. The oboe melody.
3. The beginning of the coda, which at first sounds like the end of the composition.

COMPOSING No.

SOME BASIC MUSIC

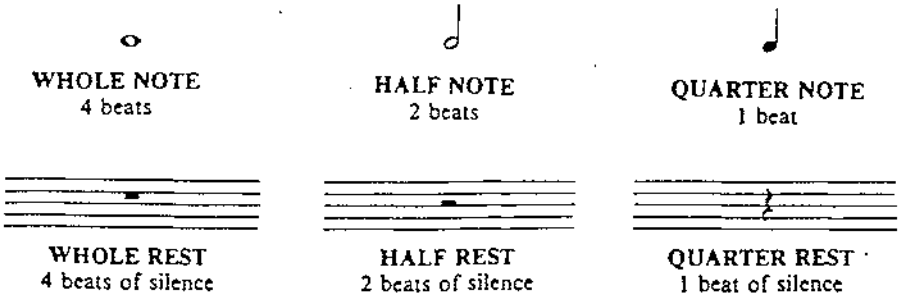
① RHYTHM

STEP ONE Write the above heading and KEY IDEAS neatly into your books.

KEY IDEAS

1 TIME VALUES

Divisions of time in music are called beats. The physical appearance of a note tells exactly how many beats it receives. The following illustration shows the most common types of notes and their time values.



WHOLE NOTE
4 beats

HALF NOTE
2 beats

QUARTER NOTE
1 beat

WHOLE REST
4 beats of silence

HALF REST
2 beats of silence

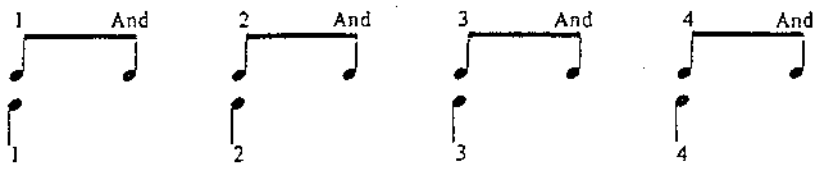
QUARTER REST
1 beat of silence

2 COUNTING

When a quarter note is divided in half, a new type of note called the eighth note is formed. Eighth notes are played twice as fast as quarter notes. Each eighth note (♪) or eighth rest (𝄾) is worth 1/2 beat.

Because it takes two eighth notes to equal one quarter, it is then possible to have eight eighth notes in each bar.

When playing eighth notes count as follows:



3 BAR LINES AND MEASURES

Each staff is divided into sections by vertical lines called BAR LINES. The sections between bar lines are called MEASURES. A double bar line (‖) indicates the end of a song.

Appendix Twenty

Cycle Two - Putting Motives, Bass, Chords together

Here is a simple piece of music you can put together and play in class. It will sound like a pop song from the 1950s because it uses a bass line that was very popular at that time. Rock and pop often use the same bass lines and there are some standard patterns that have become very popular among musicians. This is one of them.

One of the most important facts about bass lines in popular music is that they play the same thing over and over. The correct musical term for a repeated musical idea is **ostinato,** so we can say that in popular music the bass often plays an ostinato.

The bass line is very important in all types of music because it gives the other instruments a firm foundation to build above. Most of the time, the bass line is given a strong rhythmic feel to keep the music moving along.

Before you put all the parts together in this piece, answer the questions around the music and practise each part separately.

a) What clef is this?

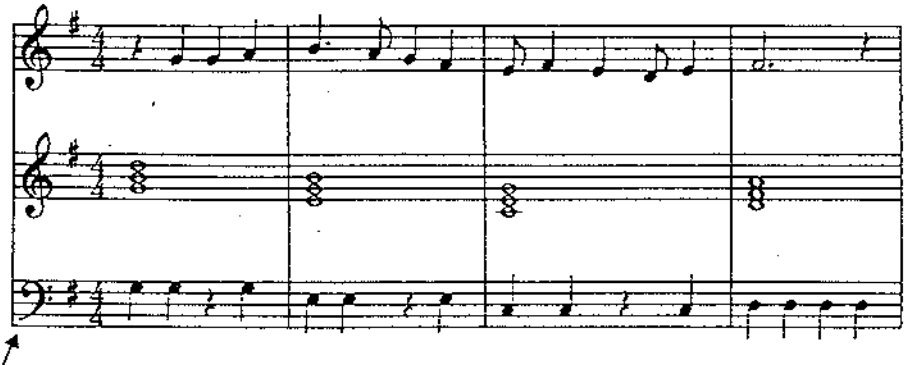
c) What is this?

b) Fill in the names of the instruments

Melody ____

Chords ____

Bass ____



d) What clef is this?

e) Fill in the missing clefs