✍ Chapter 1 – Introduction

This chapter gives an overview of the main aim of the study. This is followed by a brief explanation of the background and the contextual situation of Tanzania where the study was conducted. The remaining sections deal with the purpose, design, and significance of the study. The main aim of the discussion in this chapter is to identify how Gardner's theory of multiple intelligences can be used in teaching and learning processes and how the performances of learners who use computers in schools may consequently be assessed and improved.

1.1 Introduction

Schools in Tanzania and around the globe are scrambling to make sure that learners do not end up on the wrong side of the digital divide (Nelson, Post & Bickel, 2003). As a result of pressure from politicians and parents and because of the imperatives of the contemporary working environment, public schools are purchasing as much computer hardware, software and Internet connectivity as they can afford to create the kind of up-to-date "wired" or "high tech" environment that learners need for their training in computer and other digital technologies (Nelson et al., 2003). What has become evident is that even in those cases where schools have been able to purchase the latest technology and provide the kind of training that such technology requires, the quality of instruction and learner participation in learning and achievement have not necessarily shown improvement (Nelson et al., 2003).

Why is this the case? The answer may be located in the fact that the technology used in such environments has been utilised and implemented in ways that have undermined meaningful learning (Newmann & Wahlage, 1993). To support and encourage meaningful learning, teachers need to select models of instructional design that might incorporate methods that encourage the use of activity teaching methods and problem solving approaches that also encourage learners to participate actively as they acquire practical experience of the various forms of technology with which they interact with (Computer Studies Syllabus of Tanzania, 1996, p. iii).

McCombs and Stiller (1995) claimed that there is a way of encouraging meaningful learning using the technology of computers as a function and means for eliciting motivation, learning and achievement among learners in schools. An instructional design that can be used is that which provides learners with opportunities to train and at the same time use computer technology in learning in learner-centred instruction. Learner-centered instruction can take care of both the design and implementation of the learning process.

One of the features of learner-centred instruction is that teachers have to be trained to regard each learner as unique and capable of learning (McCombs & Stiller, 1995). This is a necessary condition for the success of learner-centred instruction because it enables teachers to create situations in which the rich diversity, uniqueness and individual differences in learners' talents can all be maximised for solving complex problems in the so-called real-world. In traditional educational contexts that are not learner-centred, the diversity, uniqueness and individual differences of learners are regarded as obstacles to learning because, in such situations, it is the ability of learners to reproduce authoritative discourses uncritically and unquestioningly, and that is regarded as one of the most important indicators of learning.

McCombs and Whisler (1997) also pointed out that wherever learner-centred instruction is used in learning situations, learner performance or the demonstration of knowledge skills need first to be properly understood, identified and appropriately described in the context of what learners can achieve in day-to-day performances in their schools. A learner-centred perspective affirms the possibility of learning for all learners because it asserts that:

- Learners are distinct and unique. Their distinctness and uniqueness must be attended to and taken into account if learners are to engage in and take responsibility for their own learning.

- Learners' unique differences include their learning rates, learning styles, abilities and talents. These must all be taken into account if all learners are to be provided with the necessary challenges and opportunities for learning and self-development.
- Learning is a constructive process that works best when what is being learned is relevant and meaningful to the individual learner and when each learner is actively engaged in creating his or her own knowledge and understanding by connecting what is being learned with prior knowledge and experience.
- Learning is most effective in a positive environment. A positive environment is one that is characterised by positive interpersonal relationships among all participants whether teachers or learners, by interactions that are comfortable and orderly, and is such that learners feel appreciated and personally acknowledged where appropriate (McCombs & Whisler, 1997, p. 10).

The approach described above by McCombs and Whisler, is located within the theory of multiple intelligences put forward by Howard Gardner (1983). What is intelligence then? Leonard (2002) defines human intelligence as an ability to perform in problem solving activities, to use logic, to think and read critically. In the theory of multiple intelligences Gardner (1983) posits that intelligence is pluralistic and hypothesises that everybody has at least eight intelligences which reflect different ways of interacting with the world (that is multiple intelligences). These intelligences according to Gardner (1983) are verbal linguistic, logic mathematical, visual spatial, bodily kinaesthetic, musical, interpersonal, intrapersonal and naturalistic intelligences. Every individual has a unique profile of these intelligences that may be manifested as different kinds of strength and weakness, and can be used singly or in various combinations to solve problems and fashion products (Gardner & Walters, 1985).

The theory of multiple intelligences, therefore, conversely emphasizes the processes of *learning* rather than teaching, where teachers are challenged to notice and take into account the diverse skills, abilities, talents and preferences that learner's can exhibit in the classroom. Learners then can be allowed to present their material in ways that recognize and consider the multiple intelligences of each individual learner. In practice

this type of instruction can be achieved because each of the multiple intelligences has a specific set of abilities that can be observed and measured (Gardner, 1983, 1999b).

Hence, in school situation, teachers have to structure learning activities *around* in such a way that they develop strategies that will allow learners to demonstrate multiple ways of understanding and teachers have to honour the uniqueness of these learners. **The intellectual puzzle driving this study is to understand the interaction between multiple intelligences and learner performance in open-ended digital learning tasks.**

Gardner's theory of multiple intelligences forms the framework of this study. To be able to understand the possible interactions between multiple intelligences and learner performance in open-ended digital learning tasks, a qualitative research design is used. Most of the studies done in relation to the theory of multiple intelligences by Gardner have also been more qualitative then quantitative designs.

Even though the theory of multiple intelligences is highly recognized and widely used, it has never been accepted wholeheartedly in either the field of psychology or in the education arena. There have been serious critiques against this theory of multiple intelligences. For example, Gardner has been criticized for not offering a clear programme for educators to use as they implement the theory of multiple intelligences in schools (Levin, 1994); he has also been criticized for not providing a way to measure or assess many of the postulated intelligences within the scope of the theory (Klein, 1998; Granat, 1997). Furthermore, Ceci (1996) did question the validity of the theory of multiple intelligences on the basis of its lack of supporting scientific data (more critiques, and Gardner's counter responses are addressed in chapter 2, section 2.8).

However, despite the critiques of the theory of multiple intelligences, the theory of multiple intelligences remains firmly in current use especially in education and school systems. The main reason as to why the theory is still considered to be valid and why it can be used for educational purposes is because Gardner expanded the hitherto dogmatically limited concept of intelligences. This expanded view includes intelligences

such as musical, visual spatial, bodily kinaesthetic, naturalistic, intrapersonal and interpersonal intelligence (among others). The suggested intelligences amended the widely accepted and institutionalised logic mathematical and verbal linguistic intelligences (Wilson, 1998, 2002; Brualdi, 1996; Campbell, 1991; Armstrong, 1994).

As mentioned earlier, the theory of multiple intelligences emphasizes learning process that provides learners with guidance and opportunities for learning academic material in different ways. Diaz-Lefebvre (2004, p. 51) puts forward some premises of learning using multiple intelligences and these are:

- It is accepted that not all learners learn or understand academic materials in the same way.
- Learners are provided with opportunities to explore various ways of learning, of getting out of their 'comfort zones', of being creative and of having fun. While the teacher is there to provide encouragement, support and confidence in the learner's ability to succeed.
- Learning environments that are encouraged are those with sustained hands-on practice and procedures, providing materials and problems with the aim of achieving deep knowledge and skill within it.
- The use of alternative assessment to provide choices and creative options that accentuate different intelligences. Creativity and use of personal imagination are greatly encouraged and rewarded.

1.2 Aim of the study

The aim of this study is to understand the interactions brought forward by the learners in the learner-centered instruction where learners (with multiple intelligences as hypothesized by Gardner) will use computer technology in a classroom situation. These understandings will help to answer the critical research question of this study which is: **How do learners with different intelligences engage with and execute open-ended digital learning tasks?**

As with any effective integration of computers into teaching and learning processes in learner-centered instruction it has to ensure that the instructional design to be used can produce optimal effects in the use of computer in the teaching and learning environment. The learning environment is learner-centered and where learning is the focal point, learners are always engaged in complex, hands-on activities that allow them to develop their understanding of the world around them (Kovalchik & Dawson, 2004, p. 401). These activities may involve engagement in authentic research; use of technology for gathering information, communicating with experts, or developing understanding; and engagement in other real-world activities to support learning (Kovalchik & Dawson, 2004).

In learner-centered instruction, therefore, teachers have to design teaching strategies that will address diversity of learners through the belief that learners can take responsibility in their own learning processes. As each learner brings a particular understanding of the world, with particular background experiences to every learning opportunity. Gardner (1993c) therefore, recommends designs of instruction in learner-centeredness to consider not only the learner-centered environment but also the assessment process which addresses the wider range of intellect present in the classroom. As always in traditional teacher-centered teaching, instruction has always been geared toward verbal linguistic and logic mathematical intelligences, with instructors and designers failing to take into account the presence of other intelligences. Examples of evaluation that remain sensitive to individual differences include portfolio development, journaling, and other types of reflective assessment (Gardner, 1993c).

Gardner (1983) is of the opinion that intelligences can best be assessed by means of a performance assessment process. This kind of performance assessment is a valuable and creative alternative to traditional standardised multiple-choice tests because they require learners to perform significant tasks directly. This allows learners to demonstrate competence by constructing and doing, rather than by merely selecting from a range of finite responses that often provide no scope for creativity, ingenuity, courage, leadership or lateral thinking – or any of the other modes of activity and self-presentation that reveal

the presence of alternative forms of intelligence in learners (Worthen, 1993). In this case, the teaching and learning of computers can also consider the effective use of assessment process that will appreciate the unique abilities of the learners, and this is the use of performance assessment or alternative assessment. Proponents of performance assessment or alternative assessment are of the opinion that the use of computers in classrooms can provide authentic learning opportunities for learners if instructional designs are well planned (Means, Blando, Olson, Middleton, Morroco, Reinz & Zorfasr, 1993).

When teachers plan a sequence of lessons, they should devise computer applications that can be used in the so-called real-world environments that use authentic tasks which are real-world examples. They should also create actual environments or simulate environments that will allow learners to complete the tasks that they have prepared – as paid workers do. If computers are optimally used by both learners and teachers, it can also be catalysts for on-going changes in classroom roles and in organizations because they tend to make learners more self-reliant. The kind of problem that a computer presents also encourages learners to work in a collaborative format and this frees teachers to function more as facilitators than as “talking heads” or lecturers (Means, 1997). To use computers as tools for accomplishing meaningful tasks is one of the many possible strategies that can help teachers to reach those learners who are unresponsive to the more traditional teaching methods of teaching that one might colloquially call the “chalk and talk” approaches (Hoerr, 2002). The theory of multiple intelligences harmonizes with teaching that is learner-centred because it suggests the use of assessment process that is more reliable and it takes the varying intelligences of the learners into account (Hoerr, 2002). Computer learning situations can provide an ideal format for assessing these multiple intelligences that are such an important part of our lives and that only now are beginning to be recognised in institutional learning situations.

Currently, the new methods of instruction that are learner-centered have become a matter of great urgency in our schools, where they have not yet been implemented because the current traditional methods, that consist mainly of drill and practice are not effective for

teaching computer-assisted learning. Pelgrum and Plomp (1993, p. 6) describe how computers are used throughout the world in secondary education. Their study confirms that apart from presenting opportunities to engage in drill and practice, computers are used mainly to teach learners basic computer application skills. They (Pelgrum & Plomp) also made an important observation that most learners do not get opportunities to practise the skills they have learned in imaginative and challenging ways or to learn new and innovative skills and strategies from problem solving approaches that would encourage them to participate actively in the creation of their own learning. In other words, unique opportunities to implement activity-teaching methods that permit learners to exhibit individual drive and initiative and collaborative enterprise are being lost.

Gardner's (1983) theory of multiple intelligences is by implication critical of the deficiencies of the old-fashioned traditional view of intelligences that are skilled mainly in verbal linguistic and logic mathematical abilities. Teachers are therefore advised, on the basis of this understanding, to construct authentic tasks that will give their learners opportunities to use their multiple abilities, talents and intelligences to the full so that these less traditional modes of intelligence can be strengthened and enhanced and given their due weight and value in both personal and community life.

It is not the aim of the study either to prove or disprove Gardner's theory, but rather to use it as a framework for evaluating differences in learners' performance in the same task and identify the different interaction processes involved.

1.3 Background of the study

1.3.1 Current use of technology in schools

The use of computers in schools throughout the world is no longer confined to the major industrialized countries alone. This is evident from the 1999 International Association for the Evaluation of Educational Achievement (IEA) study as cited by Quellmalz and Kozma (2003). Also, another study conducted by Pelgrum and Anderson (1999) entitled Second Information Technology in Education Study: Module 1 (SITES M1), confirms the findings of other researchers who have shown that significant investments in

educational information and communication technologies (ICT) have been made throughout the world and that a great deal of this investment has taken place in schools. This proliferation in the educational use of educational information and communication technologies has been driven and supported throughout the world by evidence that these new technologies can make schooling a much richer and more rewarding experience and so improve the quality of education that learners receive (Bracewell, Breuleux, Laferriere, Benoit & Abdous, 1998; Coley, Cradler & Engle, 1999; Means & Oslon, 1995).

These different studies however, have revealed that the benefits of educational information and communication technologies are that they can transform schools and classrooms by making it necessary to adopt new and improved curricula that focus on real world conditions and on simulations of such conditions. Educational information and communication technologies also provide scaffolding and tools for enhancing learning, and they give both learners and teachers more opportunities for feedback and reflection. The very nature of such technologies permits the creation and maintenance of local and global communities that include learners, teachers, parents, practising scientists and other interested parties (Bransford, Brown, & Cocking, 2000).

Such technologies also increase the demand for intelligent and precise accountability. Quellmalz and Kozma (2003) have noted that where public and private organizations make a major investments in sponsoring educational information and communication technologies in schools, there is a corresponding pressure to demonstrate that a worthwhile return on the investment has taken place. The attempts of documenting the real impact of educational information and communication technologies have not been significantly captured by traditional assessment approaches (Burns & Ungerleider, 2002; McFarlane et al., 2000). In support of this assertion, one may adduce the research undertaken by Crawford and Toyama (2002) who found that most of the tests that are conducted in schools tend to be techno-centric: that is to say, they test what learners know about the *technologies* and on how to operate them and little else. Forms of assessment that are not purely techno-centric are therefore required. Such forms of

assessment will incorporate innovative approaches that will permit assessors clearly to discern whatever new forms of learning are associated with the use of educational information and communication technologies. What is most needed are forms of assessment that will reveal very clearly the ability of pupils to externalise the presence within themselves of the multiple intelligences that are present in all human beings. This will present a much richer, more layered and comprehensive picture of each pupil's individual worth and ability. It will therefore enable investors to obtain more detailed feedback on what their investment in educational information and communication technologies has achieved. The ability of learners to manipulate different features of a particular technology is but one small component of the bigger picture that gives an accurate reflection of what a learner has gained from a technology (Quellmalz & Kozma, 2003, p. 390).

1.3.2 Why are schools not using computers effectively?

An international survey and study undertaken in 23 countries by Pelgrum and Plomp (1991) revealed that the most pressing problem that schools encountered as they implemented the use of computers among their learners was a shortage of both software and hardware. This deficit obviously has impacted negatively on all attempts to integrate computers with existing lesson practices (Pelgrum & Plomp, 1991, p. 36). Pelgrum and Plomp also identified four problems that were most frequently mentioned in their surveys. These problems relate to

- lack of hardware
- lack of software
- the inability of teachers to find enough time to learn what they need to know about computers and to prepare adequately for lessons in which computers will be used and
- deficiency in applicable computer-related knowledge among teachers themselves.

These problems have forced teachers to fall back on a position in which they use drill and practice as their main teaching and learning approaches (Pelgrum & Plomp, 1991). Where learning about educational information and communication technologies is mostly

integrated into the school curriculum as a subject that is called (variously) *computer literacy*, *computer science* or *information literacy* (Law & Plomp, 2003, p. 16). Other findings from the study by Pelgrum and Plomp, indicate that while learners are taught basic computer application skills, they do not get opportunities to use whatever other skills they may have or demonstrate other performance abilities. Apart from the fact that teaching and learning relies mainly on drill and practice procedures, the study revealed that computers are used in attempts to implement collaborative learning since teachers arrange classroom dispositions in such a way that 2-3 learners are made to share the available equipment such as a computer. Pelgrum and Plomp (1991) also found that learners are divided into groups that accommodate the availability of equipment rather than in terms of a considered didactic master plan that had been drawn up before the teaching programme commenced. This indicates how urgent is the necessity for a rational instructional process that takes all factors into account – one that will maximise the computer application skills that learners will find most helpful beyond the school system.

1.4 Tanzanian context

1.4.1 ICT status in the education system in Tanzania

Tanzania has made a remarkable progress in deploying educational Information and Communication Technologies (ICT) so as to redress unmet demands and competition in the newly liberalised markets (National ICT Policy, 2003). In the learning context however, very few educational institutions have computer laboratories or other multimedia facilities that can be used for teaching computer application skills to the majority of learners (Kafanabo, 1999). Such facilities tend to be found in private schools rather than in public schools. At universities and other higher learning institution the situation is similar: few computers are available for use by learners and the academic staff. Those that are available are too few to meet the demand for access and use. In addition, their scarcity creates numerous problems with regard to accessibility of facilities and their possible use in teaching and learning processes (National ICT Policy, 2003, p. 4).

As part of a government initiative to introduce computers in schools the Ministry of Education of Tanzania asked heads of schools to allocate and prepare a room that could be used as a computer laboratory. The main advantage of a common location remains in the cost-effectiveness in resource utilization: the evidence is that more teachers and learners use the computers for a greater fraction of the day (Becker, 1998). But the main disadvantage of computer laboratories is the inability of teachers to seamlessly integrate computer activities during a varied instructional day or period. Nonetheless, at present most government schools throughout the country have rooms that have been allocated and prepared for use as computer laboratories. But up till now, only a small number of schools have received the computers that were promised by the government (Tilya, 2003). Some schools have computers that have been donated by various organisations. Others have privately owned computers. But in most cases the computers are old models that have small memory capacities and no CD drives. Few of them are connected to the Internet and most are too slow and have too small a capacity to upload and present current educational software programmes (Kafanabo, 1999; Tilya, 2003).

Currently, the newer computers are not only faster and contain more memory for storing larger and more complex programs, but they can be equipped with features and peripherals that enable them to perform a wider variety of functions and to do so with less demand on the novice user. CD-ROMS for example, contain entire encyclopaedias and large motivating multimedia content. More exciting uses of computers for learners can be: desktop publishing, use of analytic graphing and calculating software, drawing packages, information gathering from encyclopaedias, electronic mails, and use of World Wide Web (Becker, 1998, p. 21).

1.4.2 Introduction of computers in Tanzanian secondary schools

The overall implementation of computers in schools is still in its early stages in Tanzania. Schools that have computers have between 4 and 20 and some of them have one or two computer laboratories. The infrastructure of the computer laboratories is still a serious issue because most of the computers are old and there is no networking. There are also no Internet connections or educational software in many schools. In addition,

there have been no professional development in Tanzania on the educational information and communication technology front for teachers teaching subjects other than computer technology (National ICT Policy, 2003, p. 4).

In an attempt to make educational information and communication technology functional in a daily routine and in reality in the education system, the government of Tanzania, through Tanzania Institute of Education (TIE) officially introduced a Secondary School Computer Science Syllabus for Forms I to VI in 1996. Because the responsible officials knew that simply possessing the technology alone could never have any beneficial educational effect, they recognised that it was necessary to integrate educational information and communication technologies meaningfully with the curriculum and instruction. Only a few learners have up till now taken these courses. The lack of a proper and effective programme for training teachers to use computers and other multimedia has been identified as a major reason for relative lack of interest in computer studies programmes in primary and secondary schools (Tilya, 2003). In addition, the absence of well-established information and communication technologies professional profiles and standardized processes of evaluation and certification for the different courses that are offered in various training centres, have discouraged many who would otherwise have been interested. Where proper conditions prevail, the use of educational information and communication technologies is believed to enhance effective delivery in education. The benefits that accompany the utilisation of information and communication technologies in education have only been evident in some schools and colleges in urban areas of Tanzania (National ICT Policy, 2003, p. 4).

The biggest challenge that faces many schools in Tanzania now, which is the main concern of this study is how to integrate the computers that are available with teaching and learning processes in a normal classroom situation given the current infrastructure and resources. At the time of writing, there is not a single government school in Tanzania that is seriously implementing the new computer syllabus that appeared in 1996. Teachers do not take any initiatives to help learners to use the computers that are available for doing projects or for performing other educational tasks

using performance competencies (other than computer skills themselves). Instead learners' are subjected to activities that include learning basic computer skills, drills, generic computer applications such as word processing for the purpose of general 'computer literacy', and more time is spent learning how to type on computer keyboards and to use word processing programs. What in fact happens now is that a handful of teachers use the computers for word processing and in some cases for processing examination results (Esselaar, Hesselmark, James & Miller, 2001, cited by Tilya, 2003). This means that no pedagogical expertise is present in most classrooms. The suggestion has been made by Means et al., (1993) that effective use of technology in the classroom is to provide learners with authentic learning opportunities and experiences. Teachers who have the necessary skills could use technological applications to simulate real-world environments and conditions for the benefit of learners who would then be able to get a taste of the kind of conditions that they are likely to encounter after they have left school.

By using computers as a catalyst for innovative learning and teaching, teachers will be able to exert a positive influence on learners who do not, for whatever reasons, flourish in the traditional time-hallowed classroom set-up with all its associated limitations and restrictions on the multiple intelligences of learners. In the computer-based teaching and learning environment, teachers can, for example, create innumerable plausible formats that simulate conditions that obtain in the world outside the school. Alternatively, teachers can arrange for their learners to work on tasks that have an immediate bearing on their own lives and the lives of those in the various communities, in which they live, work and play. Apart from the fact that a vast array of educational software already exists in various places, computers readily lend themselves to the creation of gaming formats that will if imaginatively applied, improve learners' learning skills and their awareness of their talents and potentials (Hoerr, 2002). Thomas Hoerr (2002) asserts that if teachers use a variety of formats to teach what in the past was only taught in conventional chalk-and-talk formats, the scholastic intelligence of pupils, as well as the multiple intelligences that I have referred to above, will be challenged, sharpened and extended without the excessive intervention that conventional teaching formats require from teachers. Innumerable formats are already available to teachers in the form of software. If teachers

make judicious choices from among the various kinds of software that are readily at hand, they will be freed to some extent from the excessive amount of time-consuming preparation, moderation and petty administrative tasks that are part of any conscientious teacher's lot.

Teachers can then use the time that they gain in this way to work in an interactive way with learners. In a properly designed computer-assisted teaching environment, teachers become facilitators who move among learners in a helpful and supportive role rather than the sole authoritative focus of all modes of learning and achievement. The obligation for achievement in learning then shifts in a subtle but decisive way onto the shoulders of the learners themselves. They then have to make choices about what they want to learn, how they will learn it and the amount of effort that they are prepared to invest in their own learning and in interactions with their fellow learners. And then because the onus has shifted, the responsibility for learning also shifts. The teacher then becomes a facilitator and the repository (although by no means the sole one) of skills, knowledge and vision of where the teaching-learning enterprise might lead and how it can work to the learners' advantage.

In such conditions, many traditional problems are those that are historically associated with education, such as the discipline of learners and learner motivation. These problems then simply eliminate themselves over time as the purpose and ethos of a computer-based educational environment establish themselves in the teaching-learning milieu. Once a computer-based educational environment has established itself in the minds of teachers and learners alike and gripped the imagination of all concerned, the long-term value, importance and profitability of a computer-based teaching-learning environment becomes obvious to everyone, whether they are immediately involved or are merely observers. What becomes evident to all observers is that computer-based teaching and learning is not merely an extension of old, insufficient didactic methods; the old classroom in which boredom, meaningless repetition, puerility and unspeakable tedium and skewed power relations are the order of the day. What users and non-users of computer-based teaching and learning alike perceive is that the computer-based classroom (more rightly called a

laboratory because a laboratory is based on hypothesis, experiment and skill) requires a radically new didactic model in which the teacher becomes a *facilitator*, and learners become self-actualising responsible citizens who are required to make their own decisions about their personal progress, application, discipline and future. Unless a computer-based teaching and learning environment operates according to this didactic model, no amount of expensive hardware and progressive software can prevent computer-based classrooms from becoming expensive failures, moribund enterprises and disappointing initiatives.

The use of multiple intelligences approach to teaching must be "learner-centred" if it is to be effective and a product of excellence. It is up to teachers to change the way in which learners acquire authentic learning, and this can only be done by changing the didactic model on which they base their teaching. The theory of multiple intelligences implies that each human being is an inexhaustible treasure house of potentials. Traditional methods of teaching in which all lines of authority, knowledge and aspiration converge on the doubtful figure of the traditional pedagogue, simply do not work effectively in a computer-based teaching and learning environment. The computer-based environment – given adequate, up-to-date facilities and properly trained teachers – permits on-going, authentic assessment that gives credit to learners in those areas where they are most powerful and effective. The theory of multiple intelligences allows teachers to move away from assessment strategies that measure primarily logic mathematical and linguistic skills. Of course such skills are important. But they need to be evaluated alongside a great number of other kinds of intelligence that the theory of multiple intelligences postulates.

It is clear that traditional teaching has failed in many ways and that it cannot deliver the kind of education that is absolutely necessary in a modern world that depends increasingly on computer-related skills, perceptions and attitudes. Computer technology, which changes and improves itself literally on a daily basis, has given birth to a new kind of human being – one who is skilled in all the arts, methods, techniques and procedures that are required in a computer-dominated world. Anyone who is not skilled in these requirements will be left behind in the race to improve the prospects for all human beings

on this planet. Of course there will always be a place for the paraphernalia of the old forms of teaching. But they will be used in new and innovative ways as adjuncts to a largely computerised world rather than as the primary ritual tools in the discredited authoritarian talking-head classroom sunk in the torpor, obsolescent methods and pre-technological accessories of ages past. The old classroom was predicated on the essentially fraudulent omniscience and unquestionable authority of the teacher. The new one will be more tentative, empirical, unpretentious, inventive and democratic than the old. But everything new is built on what has gone before. When we attempt therefore to install computer-based teaching and learning on a sound basis, we will have to recycle our old ideas and premises and retain what was valuable in the past in the new and challenging world of the computer-based classroom.

1.4.3 Why has the use of technology failed to improve the quality of instruction or learner achievement?

Conventional schooling is fundamentally flawed because the work that learners are required to perform has no *intrinsic* meaning or value to learners beyond the achievement of success in school. In many schools in Tanzania, for example, in those few cases where they are actually used to teach *learners*, computers are mostly used superficially, randomly, listlessly, and with no sound didactic justification for the teaching and learning of basic techniques (Tilya, 2003). The basic techniques to which learners are exposed to, include how to utilize hardware by turning monitors and central processing units on and off, loading software, controlling input with a mouse, and manipulation of the keyboard. At present, this process is outdated as more and more learners come to school already having been exposed to the use of computers at home. Currently the challenge is on how to use these same computers in the schools in a much more meaningful and productive way. Al-Bataineh and Brooks (2003) for example, noted that the successful integration of technology requires the effective implementation of learning theories, content-specific approaches to curriculum development, and effective assessment measures that will capture evidence that learning has occurred (McNabb, 2001, p. 52).

The Computer Studies syllabus introduced in 1996 by the Ministry of Education and Culture of Tanzania supports the use of alternative assessment or performance

assessment as one of the teaching strategies that should be used by teachers for the effective teaching of computer studies as a subject. The syllabus indicated that teachers are advised to use “activity-based teaching methods” and a “problem solving approach”, and that they should allow learners to obtain direct experience by working on the computers themselves (1996, p. iii). Teachers were also advised that the problem solving approach should include discovery activities and learner projects (p. iii). All these teaching methods were considered by those who compiled the curriculum to be effective in promoting higher order thinking skills. But none of these approaches are currently being used in Tanzanian schools.

1.4.4 Science education in Tanzania – the current situation

This section deals with the current situation of science teaching in Tanzanian schools. It is common knowledge that the teaching and learning of sciences has deteriorated in many schools. There is among many learners a profound aversion to science and its sister subject, mathematics. This common knowledge motivated me to devise an instructional method that can be used to improve the teaching and learning of science using computers in Tanzanian schools. The method that I developed comprised, in the main, open-ended (Zevenbergen, Sullivan and Mousley, 2001; Goodnough, 2003) digital learning tasks that I applied to selected topics from the Biology syllabus. This material can be readily integrated with the teaching and learning of computer application skills.

The current teaching and learning of sciences in Tanzania, changes in format as learner’s progress upwards through the different grades. In primary schools for example, learners are taught what is called general science, which is a combination of biology, physics and chemistry and it suits these levels. These science subjects are not taught in-depth, and usually learners are only acquainted with the basic concepts of each subject. When the learners reach the O-level grades or the junior secondary school in Tanzania, the science subjects are differentiated into biology, physics, and chemistry, and are then taught as different subjects. In each of these subjects, learners are taught theory and are given a selected number of practical activities to complete. This trend continues into A-level

grades where each branch of the science is taught in greater depth and where learners are given more practicals to complete.

Science classes in Tanzania are conducted in two major ways. The first way requires learners to attend normal classroom sessions in which learners are equipped with scientific facts, concepts and principles that are given to them by their classroom teacher. Thus, knowledge is then refined and expanded by (among other methods) self-reading and group discussion. The second way requires learners to perform practicals in laboratories in different educational settings in which students, usually in small groups, interact with materials and equipment and observe various resultant phenomena.

The most recent revision of the science syllabuses in Tanzania that occurred in 1996 was necessitated by the drastic changes up to that time in science, technology and society. These changes required that radically revised curricula be produced and implemented. The curricula concerned had last been revised in 1976. The changes thus introduced were designed to satisfy the expectations of society and make learners competent in such skills as they would need in their later careers. The ultimate purpose of the new curriculum was to equip secondary school graduates with whatever skills and competencies they would need to adapt and adjust in the rapidly changing world of the competitive job market (Tilya, 2003, p. 10).

Revised curricula were produced for all academic subjects although innovations were more prominent in the sciences than in other subjects. For the science curricula, new topics that reflected the demand for knowledge about environmental issues and new technological developments were added. The addition of these new topics implied that more content would have to be covered in the same period of time allotted because very few existing topics were removed from the old curricula. In addition to existing subjects, the entirely new subjects of computer literacy and computer science were introduced. Although the implicit teaching approach in all the curricular documents was decidedly learner-centred, this approach was not overtly addressed in the new syllabuses.

Although these changes in the curricula were very progressive, they posed difficulties for the implementation. Firstly, all the science syllabuses required that a great deal of content be covered within the stipulated period. Secondly, the syllabuses were written as schemes of work. Ideally the teaching of this content required that a large number of activities be performed. But the logistics of organising and presenting such activities to the learners concerned were beyond the capacities and abilities of the subject teachers – perhaps even beyond the organising capacities and abilities of *any* human being no matter how resourceful, well meaning or well qualified. The system as defined by the new syllabuses was therefore overloaded beyond anything that it could humanly bear and so was programmed for failure.

Thirdly, very few extra supplementary readings were suggested for the teachers and the learners. As a result, teachers were forced, as they tried merely to *cover* everything required by the syllabus, to direct the attention of learners mostly to content to the detriment of giving proper attention to activities that would enable learners to understand the science concerned by means of active involvement on their part. Because teachers were compelled to rush through topics in order to "cover" the syllabus and so prepare learners for their examinations, the quality of teaching was severely compromised – and not as a result of the best intentions of the teachers concerned on whose desks the proverbial buck stopped. Teaching methods were also naturally heavily influenced by the assessment methods of the National Examination Council of Tanzania who decreed that final examinations would consist mainly of written answers accounting for 60% and practical work accounting for the remaining 40%. In the remaining 40%, it also includes project activities for the learners, which accounts for 5%.

The predominant teaching format in Tanzanian secondary schools, as well as in the schools of most sub-Saharan countries, is the traditional teacher-centred lecture which emphasizes the transfer of knowledge and skills and which rewards rote learning, drill and memorization (Chonjo, Osaki, Possi & Mrutu, 1996; de Feiter, Vonk & Van der Akker, 1995, cited in Tilya, 2003). Such a mode of teaching allows very little interaction between the teacher and the students or among the students themselves in the classrooms

(Tilya, 2003). Though such an approach, under the best of circumstances and as part of a larger didactic picture, can be said to have some pedagogical merit, it is flawed, compromised and inefficient as a general didactic and pedagogical strategy. I have dealt with the deficiencies of the traditional teaching methods at some length in the previous section (above).

The most that can be said for it is that it can be an efficient method of conveying a lot of information in situations where there are insufficient printed materials or where the teacher cannot effectively control the rate of transfer of content in a classroom. Even then, inability to grasp and transfer material can seriously compromise even talented learners, especially in subjects such as the sciences where material is frequently complex and intricate and in which it must be transferred and recorded *correctly*. Such disadvantages ensure that the school and classroom can do little to produce the type of nurturing environment that will allow learners to reach their full potential (Green, 1995).

Yet more research undertaken by Chonjo et al., (1996) confirmed that the traditional classroom is less effective because it is authoritarian (teacher-centred), dogmatic and inflexible. This kind of approach may function well in institutions such as the lower ranks of the army where blind obedience to authority is necessary if the system is to function properly. The sheet tenacity and historical durability of this blind-obedience-and-mindless-conformity paradigm in education and elsewhere can be traced back to cultural beliefs in *all* societies in terms of which people actually *prefer* not to be given any choice to think for themselves and so reach their own conclusions. One can see why this kind of paradigm is so tenaciously adhered to in authoritarian emergent societies – especially unstable societies that are in transition or under siege from the challenges of modernism. In such societies, and even in less threatening circumstances, teachers (and all leader figures) are regarded as tribal elders who must be “respected”. This means that learners or dissidents must not under any circumstances challenge them.

Because the teaching process in Tanzania is based on traditional teaching methods, it specialises in transmitting to learners a body of knowledge and the study of problems that

have little if any relevance to most learners. Science education in Tanzania therefore relies far too heavily on the memorization of facts and not enough on attempting to understand the relevance of knowledge and its possible application to local contexts (i.e. the use of authentic tasks) so that when learners go out into post-school situations, they will be well equipped for what they find there. Lopez (2000) asserts that it is vital for developing countries to re-conceptualise and reform science teaching by including an array of authentic tasks that come to grips with burning developmental issues such as water supply, health – HIV/AIDS, industrial development, and environmental degradation and conservation. If the knowledge conveyed to learners was conceptualised so that its application was relevant to the real needs of real people and situations in the immediate society of learners, learners would rapidly become scientifically literate and competent and the knowledge they obtain would be of immense value to both themselves and to the people of the communities to which they belong.

Biology in Tanzania is a compulsory subject for all O-level secondary school learners. The reason why it was made compulsory was because it was felt that learners should have a fundamental understanding of the more important life processes that surround them. Biology, for example, gives learners an understanding of important health issues such as the HIV/AIDS pandemic, malaria and cholera, which are endemic diseases in Tanzania. Biology subject also teaches learners about genetic engineering, environmental pollution and conservation. In the current school situation in Tanzania where authoritarian didactic modes are the norm, a great number of learners absent themselves from biology classes and even from biology examinations.

As a result, science subjects and biology in particular, are becoming more and more unpopular. Studies undertaken by Ogunniyi (1996) and Muwanga-Zake (2004) have identified some of the reasons why this is so. Problems predictably include a serious undermining of teacher morale among teachers of sciences, the overloading of science syllabuses, totally inadequate time allocated to teachers for the preparation of practical classes and the care of laboratory equipment, overcrowded (and therefore largely unteachable) classes, fewer opportunities for promotion among science teachers, and

teachers doing far less than is necessary to promote in-depth science education in classroom situations. Finally, very few learners who select science as a subject in school finds themselves in schools that do not cultivate the habits of mind that are necessary for scientific literacy (Perkins, 1992).

The proper assessment of learner activities is as vital in science education as it is in other subjects. Current methods of assessment that involve paper and pencil examinations with their reliance on multiple-choice questions, matching items, and true or false questions are, as I have already noted above, totally inadequate because they cannot give a well-rounded and therefore reliable overall view of a candidate's understanding and ability. Wiggins (1997) suggests, and I am in total agreement with him, that the only kind of assessment that has any real value is one that is called authentic assessment. This is assessment in which learners reveal the whole range of their multiple intelligences by grappling in a meaningful way with knowledge, issues, problems and opportunities that are similar to those that occur in wider society and that are therefore undeniably relevant to everyone in that society.

In this study, in which I focus on the teaching of science education in Tanzania, where science is a compulsory subject from standard three of primary school to O-level secondary school, science education is beset with innumerable problems. These problems can be identified in the science syllabuses, in curriculum materials, in didactic and pedagogical teaching, and in the professional development of pre-service and in-service teachers in science education. My conviction is that by using instructional procedures and specially designed formats that have proved their worth in other subjects, situations and contexts, we can go a long way towards eliminating some of these problems and reconstructing science education so that it will benefit not only the learners themselves but also the Tanzanian society itself.

1.4.5 Current practices of assessment in computer studies in Tanzania

Assessments can take the form of tests and essays which in themselves can be an important part of instructional process (Alessi & Trollip, 2001). Instructional assessments undertaken at the end of the learning process can provide information about the level of

learning that has taken place, the quality of teaching and future instructional needs. Alessi and Trollip (2001) are of the opinion that many instructors and learners alike usually place too much emphasis on assessment as a means of assigning grades.

The theory of multiple intelligences suggests an approach to assessment that does not evaluate by means of short-answer tests. Rather, it studies the performance that is being evaluated directly, whether it is verbal linguistic, logic mathematical, kinaesthetic or social presentations. Assessment moreover should never confine learners to just one mode of self-presentation but should always allow learners to demonstrate their understanding in a variety of ways (Gardner, 1997). Gardner (1995, p. 204) suggests that the following caveats should circumscribe the assessment of multiple intelligences:

> Intelligences ought to be seen at work as when individuals are carrying out productive activities that are valued in a culture. And that is how reporting of learning and mastery in general should take place. I see little point in grading individuals in terms of how linguistic or bodily kinaesthetic they are; such a practice is likely to introduce new and unnecessary form of tracking and labelling. As a parent, or as a supporter of education living in the community, I am interested in the uses of which learners intelligences are put; reporting should have this focus (p. 204).

The implementation of performance assessment in most of the school systems in Tanzania is highly problematic and unsatisfactory. All learners in schools are required to take the national examinations prepared by the National Examination Council of Tanzania (NECTA). Teachers prepare learners for these examinations by using traditional teaching strategies and assessment methods. It seems that it would be difficult to mandate performance assessment in secondary schools because in the traditional Tanzanian educational environment, teachers have always used (and been required to use) long-established modes of assessment and examination and are therefore not trained to understand and implement performance assessment. Contrary to what some may think, performance assessment is a demanding and exact skill in which teachers need precise and adequate training if it is to be the effective tool that it can be in the hands of a skilled user to teach and be assessed in traditional ways.

Schools in Tanzania are under pressure both internally and externally to abide by conventional long-established methods of evaluating learner performance. In Tanzania such methods are comprehended in the time-honoured examination system. Because no teacher would (or should) be willing to open himself or herself to criticism by departing from what heads of schools, the ministry of education and the parents of learners expect, performance assessment would have to be mandated from the top (by order of the ministry). It would then be necessary to train teachers in this mode of assessment so that it could be an effective and trustworthy tool for pedagogical purposes – one that would be sanctioned by the community, which is the end consumer of all educational services. While there will always be people who criticise innovation, it is necessary, when innovating, to train the personnel concerned as thoroughly as possible in the skill required so as to anticipate and forestall uninformed or merely prejudicial criticism.

Any operating system has its own values and procedures that make it unique on its own. Both schools and the community in Tanzania, with the government acting as agent and guarantor, reward and endorse what they value and have come to accept as the "right" way of doing things. Learners are therefore categorised at the end of each academic year in terms of the results of the examinations for which they were entered. In Tanzania this allows learners to see how they were assessed and graded, and to see also how they stand in relation to their peers, other schools in the district and in the national context.

The National Examination Council of Tanzania and schools themselves prefer to use standard examinations because they are the form of assessment that is supported by the school and the government – and the system which learners understand and expect, however flawed it may sometimes be in concept and actuality. Appendix 1.1, for example, shows an examination that was prepared by a schoolteacher for the learners who were doing computer studies. The paper consisted *entirely* of multiple-choice questions, matching items and short answer questions. This is the kind of examination paper that the learners in Tanzania have to attempt in order to be graded for their performance. Appendix 1.2 shows another example of an examination paper; this is a National Examination paper that also consists entirely of multiple-choice questions,

matching items and short answer questions. It is immediately clear that examination papers set in this format support only memorization and recitation of facts and that they moreover favour those learners whose strengths lie in the areas of traditional intelligences (verbal linguistic and logic mathematical). It is also obvious that there is no scope for the presentation or appreciation of multiple intelligences in such a system of evaluation and assessment.

Gardner (1983; 1992) therefore, insists that if teaching is to be fair, just, scientific and (most importantly) *accurate*, it needs to have instruments in place that will examine and assess the multiple intelligences that all human beings possess and not just a narrow range of traditional skills (those identified above). According to Gardner (1992) and Chapman (1993), a preferable method of assessment would permit the multiple intelligences of learners to be scrutinised so that the many facets of human intelligence and endeavour that we all use in everyday life could be appreciated and credited as worthy of recognition and note. If such a system were implemented, teachers themselves would enjoy much greater scope for their own personal creativity, skill, authority and initiative. They could, for example, use still and video cameras to capture how learners interact with one another, use open-ended rubrics to assess learners' project and task documents which might include poems, stories, paintings, journals and drawings. All these modes provide evidence for how learners demonstrate their skills, understanding, as well as their creative and critical thinking (Chapman, 1993).

Learners who are blessed with this particular combination of intelligences are likely to do well on most kinds of formal test, even if they are particularly adept in the domain actually under investigation (Gardner, 1992). Paper and pencil tests do not permit the measurement of many worthwhile learning outcomes and forms of intelligence because they are not best measured with tests of this kind. Although this form of assessment is being ever more widely used by teachers and measurement specialists, Gardner (1992) advocates that alternative assessment offers the best means of obtaining information about the skills and potentials of individuals and is moreover more likely to be fair to the individual being assessed.

For instance, it has been recognized that the concept of emotional intelligence is a factor that should be considered in the development of criteria for the assessment of performance of learners. The idea of emotional intelligence is based on the links between social and emotional intelligence and educational outcomes such as learning, cognitive development and job success (Weare, 2004). It has been argued that if we look at those who do well educationally, the differences in work outcomes and personal success observed are more dependent on their emotional and social abilities than on their IQ.

Since the beginning of the 20th century, there has been an increasing focus on relationships, teamwork, communication and management skills (Weare, 2004) and these are essential features of multiple intelligences. Several researchers (Cohen, 1999, 2001; Elias et al., 1997) have noted that the ultimate aim of emotional intelligence work is to help produce more socially minded citizens as well as a more flexible, resilient and effective workforce. The concept of emotional intelligence has gained currency because of the realization of the cognitive level required in dealing with problems that are typically encountered in life such as solving conflicts, collaborating with others or adjustments to new environments that were not captured by traditional approaches to intelligence (van der Zee et al., 2002). Though these problems are social in nature, it is generally assumed that emotional intelligence is predictive of social success.

Boekaerts (1993) and Goleman (1995) opined that learning can be facilitated or hampered by emotions and that emotions drive learning and memory development. It was argued that emotional intelligence is a cognitive ability that overlaps considerably with Gardner's notion of personal intelligences, subsuming both intra and interpersonal forms of intelligences.

1.5 Purpose of the study

The purpose of this study is to investigate the interaction between multiple intelligences and the performance of learners in open-ended digital science learning tasks.

1.6 Statement of the problem

The current traditional school curriculum in Tanzania is heavily weighted in favour of learners who score highly in verbal-linguistic and logical-mathematical intelligence tests of the kind that are widely used in secondary schools. In such circumstances, it becomes a matter of great urgency for Tanzania to offer a more balanced range of curriculum and learning activities that incorporate, recognize and respond to the different needs and abilities (multiple intelligences) of learners. The theory of multiple intelligences provides a theoretical foundation for recognizing the abilities and talents of learners that the conventional schooling system has hitherto ignored in many parts of the world.

This theory acknowledges that, while all learners may not be verbally or mathematically gifted, they may indeed possess decisively important qualities and expertise in other areas such as music, spatial relations and a whole range of interpersonal and intrapersonal skills. If protocols existed in Tanzania to permit the assessment of a much wider range of skills and personal qualities, learners who are now marginalised by an outdated and unsuitable system would be able to receive due recognition for their unique contributions and assets. This research is designed to permit learners to participate in classroom learning that is facilitated by the use of computers and thereby gives evidence of the multiple intelligences that they possess. With modifications, this design could become the prototype for implementing computer-assisted teaching and learning in classrooms throughout Tanzania and wherever else the same conditions apply.

My assumption is that the current mode of assessment is both skewed and unfair to most learners. The problem I set myself was to design a protocol that would enable me to perceive multiple intelligences directly in a classroom format, using computers with minimum technical resources that I had predetermined rather than by means of the customary time-honoured paper-and-pencil tests that is predominant in Tanzanian schools. My further assumption is that it is a matter of considerable concern for the education system in Tanzania to discover and utilize modes of assessment that make use of authentic and open-ended tasks and that are therefore able accurately to reflect those skills, attributes and qualities that each individual learner possesses.

1.7 Critical research question

How do learners with different intelligences engage with and execute open-ended digital learning tasks?

1.8 Design of the study

The study used a qualitative research design and employed several data collection instruments which are questionnaire and interviews, open-ended tasks, and observation checklist. My aim was to describe and explore the interactions between multiple intelligences and the performance of the learners in open-ended digital learning tasks in the context of computer studies and the teaching of a science subject (Biology) in a classroom situation. A descriptive approach was used to record the interactions between multiple intelligences and the performance of learners in open-ended digital learning tasks (Creswell, 1998; Merriam, 1998; Patton, 1990). The research was conducted in Dar es Salaam and the Iringa Regions of Tanzania in four selected secondary schools. A purposeful selection of the schools was done so that I would get access only to schools that had computers with floppy and CD drives, (whether or not they had Internet connections did not matter). I also purposively selected learners from form two and form three (equivalent of grades 9 and 10) for the study because these learners were taking computer studies courses in their schools.

I used Howard Gardner's (1983) theory of multiple intelligences as the theoretical framework for the study. According to the theory of multiple intelligences propounded by Gardner (1983; 1996), there are eight different intelligences, which he classified as follows: verbal-linguistic, logic-mathematical, visual-spatial, bodily-kinaesthetic, musical, interpersonal, intrapersonal and naturalistic. For the purpose of this study I focused on only four intelligences, namely logic-mathematical, verbal-linguistic, visual-spatial and interpersonal intelligences. I based the selection of these four intelligences on the performance assessment procedures that I used. These comprised three open-ended digital learning tasks that learners were required to complete with the use of computers. These tasks were executed and completed in a classroom situation, using only the available resources (computers with no Internet connection or CD drives, but with

properly functioning floppy drives) and this constitutes the first criterion. The second criterion considered the expertise of the researcher and the school teachers (Wiggins, 1993).

I based the assessment of the learners' performance abilities on an interpretive understanding of the theory of multiple intelligences by looking at the strategies and skills that learners preferred and used to complete the tasks and how these abilities were reflected in their task documents and presentations. Learners' strengths and weaknesses in verbal-linguistic, logic-mathematical, visual-spatial and interpersonal intelligences were analysed in terms of scoring that had been defined in the rubrics. Different formats for gathering data included observations, interviews, learners' documents, presentations and scoring according to predetermined rubrics.

The learners were given three different open-ended digital learning tasks. Each task had to be completed within a week. The learners were asked to work collaboratively in pairs and were observed and videotaped as they interacted with their open-ended digital tasks, both in their paper work and as they worked on the computers. At the end of each open-ended digital learning task, the learners presented their work to their peers by using power point presentations. These presentations were also videotaped and were used during the analysis process. After working on all three learning tasks, a focus group interview was conducted (four learners in each group) with the researcher. Separate interviews were conducted with teachers and the parents of the learners. These interviews were face-to-face in format. All the interviews were recorded by means of an audiocassette recorder with the prior permission of those being interviewed.

I saved all learner documents that contained the record of their solutions to the open-ended tasks and those that recorded information about their presentations to floppy disks. In the document analysis process, all the documents and school progress reports of the learners in the sample were analysed in terms of the scoring rubrics. All recorded interviews and videos were transcribed and collated in appropriate forms with the analysis of the documents. Collectively, the analysis of all the data was interpretive and

descriptive with the aim of identify significant patterns, constructs and interactions between multiple intelligences and the performances of the learners (Gall et al., 1996).

1.9 Significance of the study

The results of this study will contribute to relevant knowledge bases, especially to those that are concerned with the theory of multiple intelligences as it pertains to the instruction and planning of open-ended tasks. The importance of this study is to provide information for teachers and curriculum developers as to how the practical application of multiple intelligences theory may take place in a classroom situation. The aim was also to show that open-ended, mainly computer-based tasks can be used effectively in the teaching and learning processes if they are augmented with appropriate forms of learner assessment processes. This study would be able to show that learners can benefit from innovative instructional methods, where computers can be used successfully in classrooms to teach learners, and that assessment methods and protocols that are based on performance assessment process are much more comprehensive, useful and fairer to learner-centeredness than the conventional tests and didactic methods that are widely used in schools in Tanzania and elsewhere.

Assessment institutions of Tanzania and especially assessment of computer-based tasks have to consider designing tasks that will promote learners diversity that is other intelligences, and other cognitive and personal strengths that are not recognised by traditional assessment instruments due recognition and credit.

1.10 Delimitation of the study

The study is confined to learners who were taking computer subjects in the schools that participated in the study. The learners had to complete all the open-ended digital learning tasks on computers because they were required to present their documents (data) in computer-based presentation slides in order to show that they were indeed competent enough to be rated as having improved their new computer application skills. In addition, a qualitative research design was employed that made use of several data collection

instruments including observations, learners' documents, presentations, completed task documents, school progress reports, and manila sheets (with visual drawings). Interviews and questionnaire schedules were also used to obtain information from the teachers, parents and learners who participated in the study. The analysis of learners' documents and school progress reports was done using scoring rubrics.

1.11 Limitations of the study

The aim of the study was to use computers to identify the instructional process that would allow me to use the theory of multiple intelligences as the framework of the study. I therefore made a purposive selection of schools that had computer laboratories and working computers that had functional floppy and CD drives. Learners were also those who were doing computer courses at the time of the research. Because of these selection criteria, only four schools were able to participate in the study.

Assessment of the performance abilities of the learners was limited to the open-ended digital learning tasks that required learners to use whatever resources were available in their schools. The resources that were available to the learners were only those that were compiled by the researcher and saved on the computer hard drives. It was not possible to use internet as all schools did not have internet connections.

Lastly, the assessment of performance abilities was limited to four intelligences listed by Gardner in the theory of Multiple Intelligences. These intelligences are namely logic-mathematical, verbal-linguistic, interpersonal and visual-spatial.

1.12 Preview of the study

A qualitative research process and findings from the investigation of the interaction between multiple intelligences and learners' performances in open-ended digital learning tasks study is presented in the subsequent chapters.

Chapter 2 presents the theoretical framework. Firstly, the origins and definition of the theory of multiple intelligences as presented by Howard Gardner in 1983 are discussed and their implications for the school curriculum are dealt with. Secondly, the assessment of learner performances are considered in those cases where the researcher devised an alternative assessment concept as the rational basis for assessing learners' multiple intelligences as they worked on the open-ended digital learning tasks that are part of the research design. The chapter also discusses the ways in which open-ended digital learning tasks can be used as an instructional method that allows learners to use their multiple performance abilities in the course of the learning process. Chapter 2 concludes with a recounting of the route that individual teachers may take if they themselves wish to prepare effective learning tasks that utilise multiple performance assessment strategies for use in their own teaching.

Chapter 3 presents the methodology that scaffolds the study. This chapter analyses the qualitative research process that is used in this study. It includes a discussion of the open-ended digital learning tasks and performance assessment strategies that were used as well as the authentic tasks, rubrics and learners' documents that were incorporated in the data collection instruments.

Chapter 4 consists of a discussion of the research findings of the study – the performance abilities of the learners, variations in intelligence profiles, and the interaction between multiple intelligences and performance of the learners.

Chapter 5 concludes with reflections on the study itself, with the conclusions that can be drawn from a consideration of the research question, and the implications of the findings and recommendations for future research.