# ✍ Chapter 4 – Research Findings & Analysis

*In this chapter I describe how learners manifested their multiple intelligences in the performance of open-ended digital learning task. This chapter examines the effect of performance assessment on learning as well as the effect of open-ended digital learning tasks on learning. The chapter concludes with a detailed discussion of the interaction between multiple intelligences and the performance of the learners in open-ended digital learning tasks.*

## 4.1 Introduction

The data presented here was assembled by means of four different methods described previously in chapter 3. Those methods were (1) observation, (2) interviews, (3) multiple intelligences survey questionnaire, and (4) retrieval of information from learners' open-ended digital learning task documents and presentations, and school progress reports. In this chapter, I will discuss the findings of the study, the investigation of multiple intelligences in relation to learners' performance in selected open-ended digital learning tasks. The findings of the study show that when the learners in this research study were given the opportunity to work on open-ended digital learning tasks, they managed to make their own preferred choices about modes of performance in the completion of the tasks. They did indeed vary in their preferred choices and performance abilities according to their intelligence profiles.

Other value-added advantages identified during the performance assessment of the learners as they worked on the open-ended digital learning tasks included computer application skills as well as the freedom that learners had to express their preference for diversity as they gave evidence of collaborative and social learning. Another important value-added advantage in their performances after working on the open-ended digital learning tasks was increased motivation, sustained attention and an ownership of the tasks among learners.

## 4.2 Value of performance assessment on learning

Performance assessment strategy that was used in the study, showed to have a positive impact in the learning process of the learners who participated in the study. The performance activities that were provided to the learners had meaningful, real-life tasks that enabled learners to demonstrate what they know and what they can do in such situations.

The use of assessment strategies to assess performance abilities changed the course of assessment where facts and figures were considered to be the main indicator of success to an ***assessment*** of what learners can do or perform. This then may be used as a basis for extrapolating learners' ***potential*** when faced with the same or similar tasks and situations. The data gave varied indications of learners' performance abilities as they worked on the open-ended digital learning tasks. Learners' performance abilities improved in the use of different computer application skills, collaborative and social learning, and self-management. The sections that follow present the discussion of how these learners performed in various open-ended digital learning tasks and presentation sessions.

### *4.2.1 Computer application skills*

Computer application skill is one of the performance abilities that had a positive effect on the learners who participated in the study. At the beginning of the study, learners were equipped only with very basic computer application skills such as the booting and closing down of a computer and the ability to use some of the features of Microsoft Word. During the course of the study, the learners were taught how to use other application skills that they would need to complete their tasks successfully. All the learners were taught how to use various features of Microsoft Excel, Microsoft PowerPoint and Microsoft Word. They thus learned how to use and manipulate graphs and tables, how to design and use pictures, clip art, animations, how to import tables and graphs to slides, and how to create and manipulate tables, pictures, clip art, font sizes, colours and word art. After this prior training, the learners were allowed to work

on the open-ended digital learning tasks and were encouraged to use all the computer application skills they could apply in their task documents and power point slides in order to make their presentations more presentable. My expectation as a researcher was that learning was much more likely to transfer if learners were given the opportunity to practise with a variety of applications and if they were encouraged to use these applications as part of their solution strategies.

The data that emerged at the end of the study showed that a good number of learners positively incorporated several computer application skills in their task documents and presentation slides as the result of being allowed to use whatever computer skill they wanted to. Thus, for example, several of the learners managed to use pictures in their text documents as well as in their slide presentations. Some of the learners however, showed eagerness to learn how to use spreadsheets and tables in their tasks. This is inferred from the fact that some learners kept raising their hands to ask for assistance from the researcher. During the interviews with the teachers, teacher Tp commented that:

> "… It seems that leaving the learners to work on their own and select what they want to do has helped them learn much more quickly than when they were to be taught the same skills in class demonstration. They have learnt more than what I expected, I am impressed..."

During the focus group interviews several learners stated that the tasks they had to accomplish, made it possible for them to make choices about whether or not they can use a certain computer application skill (some of which were already familiar to them and some of which they had learned during the research event). Those who did use these applications creatively felt that they had improved the quality of their documents and presentations, and also improved their computer skills. One learner, for example, pointed out that the continuous use of computers in the study that is three to four hours per day, has given him the confidence to use different computer features in Microsoft Word, Excel and PowerPoint. He is now confident that he can use these skills in future in other subjects. He stated *inter alia*:

> This project has helped me a lot […] because the skills I have learnt […] I was able to apply them in my tasks. For example, I used a table and also managed to draw a graph from Excel. I am happy and I will be able to teach my friends too, after the study.

From these observations, I can say that making technology (computers) available to the schools and learners does not produce an appropriate use of technology. But, the extent to which this technology is integrated into instruction, using open-ended tasks can enable learners learn more on the use and application of computer application skills.

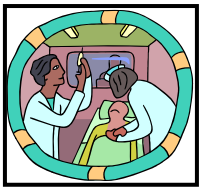
Other findings from this research study, suggests that authentic and open-ended digital learning tasks provided learners with a learning environment that was different from which they were accustomed to (i.e. the conventional and authoritarian, memorise-and-repeat after demonstration classroom format). My expectation as a researcher was that learners would be able to demonstrate their higher order thinking skills by generalising what they had learned, by providing examples apart from those that they had been given, and by applying and manifesting their different abilities (intelligences) while working on each of the tasks provided. Thus, for example, the learners were set to work on the tasks without any strict instructions about how they would answer the questions posed by the tasks and without any imposition of the kind of formal classroom behaviour that is automatically observed by all learners who have been conditioned in conventional authoritarian classroom situations.

The learners had to make their own choices and decisions about what they wanted to do and how they would complete the tasks. This gave learners opportunities to use all of their multiple intelligences and to deploy all the resources of their imagination, knowledge and other gifts to demonstrate their performance abilities and their preferences. For example, learners were given the freedom to make their own decisions about when and how to use spreadsheets and tables to organise their numerical information, when and how to use pictures to convey other information in visual format, and when and how to use other information such as text (such as poems) to convey information, emotion or other data in various formats. The fact that the learners

in the sample responded so creatively by and large to this freedom means that this new learning environment (characterised by authenticity and open-ended digital learning tasks) allowed learners to process information in different and diverse ways using different combinations of intelligences.

### *4.2.2 Preference diversity between learners*

One may assume that the open-ended digital learning tasks and encouragement to use the computer application skills that they had recently learned both to some degree stimulated learners to make their own preferences about how they would like to complete their tasks. Firstly, the learners were asked to summarise their information so that they would be in a position to present their data and thoughts to their peers. Some learners managed to add pictures in their texts because they felt a strong desire to represent their knowledge in visual form. One of the learners, for example, used several pictures in his text and PowerPoint slides. He stated that he had used pictures so that he could share in a very strong way with his peers what conditions are really like when a community is affected by cholera.



One of the pictures used by the learners in task 1: The picture shows a sick person being attended to. The message is that if people do not have clean and safe water, they may contract cholera, get ill and end up in hospital, or even die.

**Figure 4.1:** A sick person being treated.

Because the tasks were open-ended, learners made their own choice of various ways in which to complete and embellish the tasks in which they were engaged. The learners selected those modes of expression that they felt would enable them to be most successful. Thus, for example, learners who possessed a strong visual and spatial intelligence tended to select whatever pictures and clip art they could find to explain their texts. For them the use of pictorial forms of representing situations seemed to be more powerful than the use of words alone.

The presentation of activities by means of PowerPoint slides also permitted learners to set up questions that would solicit answers from their peers and commentaries from their observers (the researcher and teacher). This question and answer strategy worked well for most learners because it gave them scope for improving their communication skills. I noticed that discussions in the first presentation were not very lively. Some of the learners were shy and others asked no questions at all. But as they became accustomed to the format during subsequent task presentations and were given time to realise that there would be no adverse reactions to individual initiative and creativity, more and more learners started to ask questions and participate in discussions.

During the interviews one of the learners said that she had learned new words during the process and so had improved her vocabulary. According to her:

> My vocabulary has increased especially when learning about landfills. I did not know that landfills meant “dampo” in Kiswahili. While presenting, I knew exactly what I wanted to say.

Being expert was not only in the way they presented their tasks, but also in the ability to improve on what they have learnt. The analysis of the presentation slides showed that in the first task, the number of presentation slides prepared by learners ranged between 4 -7 slides. But with the subsequent presentation, the number of slides increased from 9 to 13. These learners were more motivated and wanted to share with their peers how well they have managed to get new information, with extra presentation slides to complete the task and contribute in the discussions.

As the learners continued to work on their tasks, some managed to use several computer application skills that ranged from the use of a picture or clip art to emphasize a point to tables and graphs that they imported into their texts and presentation slides. Most of the learners learned various animation skills that made them more expert than their teachers in this area. During the reflection session, Teacher Tn noted that he did not know how to work with PowerPoint at all. He was fascinated by how his students had managed to learn all the required skills in such a very short time. Teacher Tn

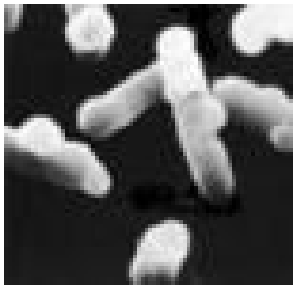
insisted that he would learn how to use PowerPoint from his own students after the study had been completed. In his words:

> I liked how the learners have managed to use different computer application skills, and especially the PowerPoint program. Look! They are confidently working on their own. I will have to learn from them after the project (Teacher Tn).

I also noticed that learners put more effort into tasks that incorporate a technology that they can manipulate and use creatively. This seems to suggest that if the uses of technology have been properly taught; such a technology may well have the capacity to positively influence the performance abilities of learners. In such circumstances, learners are able to prepare products that one could not imagine them making. This was in fact demonstrated by this particular sample of learners. One group of learners, for example, prepared a flyer with the use of a computer. This flyer was part of an educational strategy they had to select and use to educate their community about cholera and how it might affect people. These learners used columns – in Microsoft Word programme to arrange the text in such a way that the A-4 paper could be folded like a flyer for distribution purposes. This strategy was an alternative to the kind of essay question that might have been asked in a normal (conventional) classroom setting. Figure 4.2 shows the flyer that these learners prepared. Another group of learners prepared a poem. This poem was prepared as an educational strategy for their community. Clearly new skills were learned in this exercise that will be able to be used in future activities.

# Beware of Typhoid Fever!!

**Cause:**
Typhoid fever is contracted when we eat food or drink water that has been infected with bacterium - Salmonella typhi.



**Bacterium: Salmonella typhi.**

**Symptoms:**
It is recognized by the sudden onset of fever, severe headache, nausea and severe loss of appetite. It is sometimes accompanied by hoarse cough and constipation or diarrhoea.

**Occurrence:**
Typhoid fever affects 17million people worldwide every year, with approximately 600,000 deaths reported from Asia, Middle East and Latin America.

Typhoid fever is transmitted by food and water contaminated by the faeces and urine of patients and carriers, Polluted water is most common source of typhoid.

In addition, shellfish taken from sewage-contaminated beds, vegetables fertilized by night soil and eaten raw, contaminated milk and milk product have been shown as a source of infection.

**Communicability:**
People can transmit the disease as long as the bacteria remain in their system.

**Disaster Implications:**
With disruption of the usual water supply and sewage disposal, and of the elimination or reduction of control on food and water, transmission of typhoid fever may occur if there is an active case or carriers. Efforts are to restore safe drinking water suppliers and sanitary disposal facilities are essential.

Selective immunization of groups such as school children, prisoners and utility, municipal or hospitals personnel can be helpful.

**Prevention:**

- Protect and chlorinate public water supplies and avoid possible back flow connection between sewers and water suppliers.
- Sanitary manner and maintain good disposal of human faeces in a fly-proof latrines.
- Use scrupulous cleanliness in food preparation and handling.
- To educate the public regarding the importance of hand washing; this is important for food handlers and attendants in the care of patients and/or children.
- Thorough and frequent hand washing is essential, especially after bowel removal.

**Figure 4.2:** A flyer prepared by learners in task 1.

**Transmission:**

POEM

This disease caused, by typhoid bacillus,
And the name of microbe, is called Salmonella typhi,
This disease is bad, because it kills many people,
What is that disease, the disease is typhoid fever.

Symptoms of the disease, there are so many
Variety of symptoms, it occur to the person
That has contracted with Salmonella typhi,
What is that disease, the disease is typhoid fever

The spread of micro organisms, they are spread by humans,
You can get the disease, if you drink or eat food or beverages,
Those have been handled, by the people carrying the bacteria,
What is that disease, the disease is typhoid fever.

The rest of the verses of the poem prepared by these learners can be viewed in appendix 4.1

Other performance abilities that were demonstrated by learners included the use of computer application skills such as the creation of graphs and tables and the use of clip art and pictures to make high-quality products for use in classroom presentation by using basic resources that were present in the schools. Although all the learners could use whatever computer application they preferred at any time, the use of different application skills was evident among the learners in the sample. My own observations of the learners showed that this was so. I observed some learners using graphs, tables and number organization skills in order to logically present their information in all three open-ended digital learning tasks. Other learners used clip art, and other learners used pictures and drawings to represent their information in a visual way. Yet others used Microsoft Word to type their texts so that they could present them in that format. Writing skills were also augmented as learners were able to check their spelling mistakes by using the Word's Spell Check function. I also noticed that learners also managed to include more information in their later tasks than they had did in the first tasks that they handed in. Certain writing skills that were in advance of those expected of their age group were also apparent in some of the learners' texts.

Convincingly, learners were not only exposed to the used of computer application skills only, but they also practiced using these applications in the open-ended digital learning tasks and created presentations with which they themselves used to present to their classroom peers.

### *4.2.3 Collaboration and interpersonal intelligence*

During the course of study, the learners worked in collaborative couples on one computer per pair. The learners were very positive about working collaboratively. They expected that this kind of collaborative work would make problem solving easier and they also anticipated that a product produced by a pair would probably be of better quality than it would have been if it had been produced by individuals. When they were asked for their opinions about working in teams, most learners said they had gained a lot from working collaboratively. One of the learners said:

> See, I like working in groups because we learn from each other. Nobody knows everything, so we benefit from each other… For example, I managed to help Pat and Sally how to search for a picture in clip art. It was nice helping them.

This comment summarizes the view that each learner will bring his/her own experiences and learning to a situation and that each learner is capable of contributing to the completion of a task in his or her own unique way. In so doing, all the groups engaged in cooperation.

One requirement of working collaboratively to complete a task is that all meanings have to be negotiated. The learners were not initially unaware of how important negotiation is for the process of getting a task completed collaboratively even though negotiation is indispensable in all collaborative learning groups. One of the learners said she was not happy working with her colleague:

> I don't want to work with Martha anymore. She is very bossy and does not want to include my ideas in the document. What she says goes … She even

> does not want me to type the document. She is saying I am slow in typing… but I also want to contribute in the task.

Another learner pointed out some of the more difficult aspects of negotiation and working collaboratively on a common task thus:

> I quarrelled with my friend. First, she comes late most of the time; she does not want to contribute to the work, and she keeps talking to others… I was not happy with this behaviour.

The issues and potential problems that arose out of the learners' responses show that conflicts and a level of discomfort and irritation (challenge) are all possible processes and outcomes of collaborative learning arrangement. The teacher can always intervene to rectify or help negotiate a possible solution if a collaborative pair reaches an absolute deadlock. As the participant observer in the study, I had to discuss the ground rules with the learners who had problems and get them to understand and accept that everyone needs to contribute to the task at hand. In this case, each person in a collaborative pair had to contribute about half of the work. The other collaborative pairs in the groups managed to work comfortably and without any major friction or deadlocks.

The use of open-ended digital learning tasks did provide an environment in which learners could use their individual performance abilities to complete the tasks. This meant that the use of authentic tasks opened the way for each learner to apply his or her unique performance abilities to realise specific solutions to each problem that arose. In this way the open-ended digital learning tasks permitted learners to make connections between the skills and abilities that they had learned in school subjects and real-world (authentic) activities.

### *4.2.4 Social learning*

As the researcher and participant observer, I also made myself available to learners to help them – where needed and specifically requested – work through their tasks, especially when it came to matters such as computer trouble shooting and assistance with computer application skills. My main aim in being thus available was to clarify issues

and problems that were unclear to them so that they could get back into the right track and bring their tasks to completion.

The arrangement of the learners into pairs provided a good support system because each learner supported his or her partner and even on occasions offered support to friends and fellow learners in other groups (peer support). In some cases, they offered suggestions to one another but could not decide how to proceed without the assistance of the teacher or the researcher. If the problem of indecision related to some technical point, the researcher or teacher provided help. If it was a tactical issue involving the completion of the tasks, they were left to decide by themselves.

In dealing with the content of the open-ended digital learning tasks and the presentation process, they gave significant assistance to one another. The learners were quick to perceive that working with and helping one another also helped them to imprint and perfect their own learning. For example, when Rachel and Anna were asked in the interview about working in collaborative pairs, they both indicated that they were happy to work in a team because it had helped them to learn new computer skills from one another, and that it had also extended their repertoire of biology terms as they were able to complement one another in this regard. According to Anna:

> In my team, we helped each other in completing the tasks and presentations. Sally was very helpful because she taught me how to search [for] and use clip art pictures on PowerPoint slides as well as the use of tables. I am now proud of myself.

The support that the learners provided to one another was fundamental to the learning process and it helped them to complete the tasks in a shorter time than would have been possible if they had been working alone. And because of the collaborative approach, the teacher and researcher were able to play a smaller role in supporting the learners which they did only when they were requested to help.

In general, the findings indicate that open-ended digital learning tasks provide an opportunity for learners to improve their performance abilities. Thus, for example, learners learned new computer skills from their peers and from the researcher as they worked on the tasks. This evidence may encourage teachers to use such strategies in their teaching and learning processes in situations where computers are implicated.

## 4.3 Value of open-ended digital tasks on learning

There are several ways in which open-ended digital learning tasks may have impacted on learners' learning. One major possibility is that the impact of open-ended digital learning tasks on learners' learning might have been caused by the relevant content of the tasks, all of which were 'real-world problems' or 'examples of actual problems' that had or could arise in the communities from which the learners came. These tasks motivated learners to exert themselves to find real (i.e. effective and workable) solutions to the problems concerned. The fact that a great deal depended *in reality* on the effectiveness and accuracy of their solutions motivated these learners to give their sustained attention and effort to finding solutions and accepting ownership of the tasks. It was later in the observation and interview sessions with the teachers and learners that learners and teachers spoke about the influence of such *authentic* open-ended digital learning tasks on learner motivation to succeed and how this identification with the problems that they were required to solve had also encouraged them to improve their reading, writing, decision-making and computer application skills.

### *4.3.1 Learners' motivation to learn*

All the teachers who participated in the study reported that they had personally observed the degree of enormous enthusiasm that the learners had brought to the solution of their open-ended digital learning tasks. Teachers Tm, Tn and To said that they were amazed at how very hard these learners had worked on their computers and at their tasks, at how they did not be need to be reminded or prompted about what to do, how they had worked much harder than they were expected to work, and how they had worked for much longer periods on these tasks than what they were officially expected to do. They noted:

**Teacher Tm:** Some of these learners are very slow and inactive in class. But these same learners are now active and working very hard to complete their tasks. I am impressed. It seems most of the learners are competing from each other in making their work look the best.

**Teacher Tn:** These learners are now good in doing things on their own. For example, in one week, they learnt to work on their own without being pushed by the teacher to do so. They summarized the information and presented it in class on time. They have also managed to work with some computer programmes with confidence compared with the time before they started this project. For sure now, they can stand up with confidence and talk to their peers with their heads up.

**Teacher To:** They have gained a lot, and they have enjoyed the lessons so much – especially when they are presenting their slides. All the learners were involved in the discussion. Look, they keep working and working until they have to be told to stop working because time is out. When I teach them they do not stay that long. When the bell goes, they are happy to leave.

### *4.3.2 Sustained attention*

The learners did indeed work very hard to complete their tasks. They gave the tasks their sustained attention and effort and concentrated single-mindedly on their tasks. Learners, for example, were specifically requested to utilise several of the reading resources provided and a number of the different computer applications available to them to complete their tasks. They were also specifically requested to discuss problems with one another and to help each other wherever possible. Both teachers and learners mentioned that the resources and time they were allocated to invest in the tasks encouraged them to work hard and even put in extra time to get their tasks completed by the deadline. The following are some of the comments that learners made:

I cannot be tired working on a computer especially with a task like this. I managed to read and summarize my notes, type them onto the computer and later present them to my friends. I really liked using my knowledge to help my community. My biology has improved now.

I liked the learning tasks. They where well arranged with the resources to read. I could find the answers to questions given in the handouts, and the facts were very educative.

> I was able to summarize my work, write in point form, add pictures and do a presentation that was important to me. […] I had to get things done as other learners would ask more questions if I am not sure of what I have written.

> Teacher To said: I am impressed about how the learners have taken a self-directed way of learning. They have become independent and confident in using different computer application skills apart from what they already know. They have learnt a lot of computer application skills, for example, the use of Microsoft Word (tables, clip art and pictures, word art), Microsoft Excel (data organization and drawing of graphs), Microsoft PowerPoint (developing slides and presentation to others). The presentation sessions were so motivating I could see it in their eyes and the way they talked. They did not want to finish the discussion.

When the time arrived to make presentation, learners showed their skills in the presentation of their tasks and in how they justified and debated their solutions as they looked for the best fit. They realized that open-ended digital learning tasks can present real-life (authentic) problems to solve. One learner, for example, said:

> I am happy that I convinced others that my educational strategy can be used in teaching people how to prevent the spread of cholera. That has made me proud.

The presentation process gave learners opportunities to go beyond formal written reports and communicate instead by using vivid written, oral and visual means such as slide shows, graphics and photographs. These skills were new to these learners and to their schools. During the reflection session with the researcher, Teacher To stated:

> I wish we could have this system of allowing learners to present their work in class as it provided a lot of challenge to the learners especially in gaining confidence in presenting what they have done to others.

This kind of learning process in which presentations are made to others means that, at the end the work is accepted and owned by the whole group and that is what it matters. Learners were also observed to be flexible in their use of media. In this way, by varying content, media and teaching materials, they found that they could retain a high level of audience interest and participation.

Through collaboration with their classmates and by respecting one another's ideas and inputs, these learners managed to work socially and collaboratively in a classroom setting. Most of the learners remarked that they had not realised that that time was passing by so rapidly and they therefore had to come back to complete their tasks on the following day. They were happy working together because they shared the workload and ideas and because they also helped one another to master new computer skills. In one of the interviews, one of the learners said:

> Because each person is different, people have different talents. So we helped each other in the process of putting down ideas. Finally the end product was good compared to [what it would have been] if the work was done individually.

Teachers To and Tn also noted that their learners had improved their learning through collaboration.

> **Teacher To:** I think it was a good idea that these learners worked in groups. They managed to share with each other. Especially for those who know things, they were able to help others.
>
> **Teacher Tn:** The team activity was good for the learners. For example, the learners were able to learn from their peers and they helped each other. They were also happy the way you helped them, especially when they got stuck in the preparation of the PowerPoint slides.

### *4.3.3 Learners' ownership of the tasks*

Open-ended digital learning tasks *also* provided learners with opportunities to demonstrate their decision-making skills and to take risks. They made their own decisions about what they would read, about how to access their background knowledge in biology and their communities, about how they should summarize their tasks, and about how they would present their work. They had to create professional-looking visuals to assist them to lead class discussions about their problems and their proposed educational strategies selected as solutions. This was important as they had to have sound reasons as to why they had selected their educational strategies and why they had thought

a particular strategy would work in their communities and what informed decisions they had made to arrive at their solutions. All these decisions compelled them to take ownership of the task documents that they had prepared. In one of the interviews, one of the learners said:

> I managed to prove to myself in class that I can make it. In our group we proved to our friends that our strategy was the best. The way we managed to summarize our ideas, and justify the use of the strategy… That was cool!

In short, I think that the open-ended digital learning task format and the performance assessments helped the learners in areas that meant a great deal to them. The tasks equipped the learners with how to handle the complexities and uncertainties of a world that they knew existed but which they had not hitherto found any point of inspired access. Learners were inspired by the real-world activity format because it enabled them not only to collect and share factual information with their classmates; it also compelled them to synthesize what they had learned, to integrate it, and to make decisions and then justify those decisions in front of others.

In real-life situations, efficacy means finding out what the best is that one can do when confronted by tasks and possible solutions to apparently insoluble problems, and how one can take ownership of tasks so that one has a personal stake in the solution.

## 4.4 Interaction between Multiple intelligences and performance of the learners in open-ended digital learning tasks

The investigation into the interaction between multiple intelligences and the performance of learners in open-ended digital learning tasks took place in two stages. These stages required me to

(1) ascertain the intelligences profile (relative strengths and weaknesses) of the learners, and the relationship between the intelligences profile and performance of the learners,

(2) assess learners' tasks and presentation documents and identify their performance abilities in computer application skills in terms of four intelligences (logical-mathematical, verbal-linguistic, visual-spatial and interpersonal intelligences).

### *4.4.1 Intelligence profile of the learners*

The intelligence profiles of the learners described in this section are those of learners from three urban schools in Dar es Salaam and one rural school in the Iringa Region of Tanzania. I chose as respondents a total of 40 learners. Of this number, 30 were learners from the three schools in Dar es Salaam while 10 were learners from the one rural school. There were 23 females and 17 males in the sample. Whereas Gardner (1983; 1996) documented nine intelligences, for the purpose of this study I focused only on four intelligences, namely the logical-mathematical, verbal-linguistic, visual-spatial and interpersonal intelligences.

I ascertained the strengths and weaknesses of the learners' intelligence profiles for each of the four intelligences from two assessment sources. These sources were (1) the multiple intelligence survey test instrument, and (2) school progress reports of the learners. This data has been summarised in Table 4.1 below. The outcome of the assessment gave an indication of the strengths and weaknesses of the four selected intelligences of these learners. I later also used the findings from these two sources to compare the performances of the learners as they worked through the three open-ended digital learning tasks and presentations to their scores for these four intelligences. My aim in comparing these two sets of data was to identify the relationship between the performance abilities of the learners and their four intelligences profile.

**Table 4.1:** Intelligence profiles of all the learners for four intelligences

| Schools | | Logic | | Verbal | | Visual | | Interpersonal |
|---|---|---|---|---|---|---|---|---|
| | Learner | IS | SR | IS | SR | IS | SR | IS |
| Dar Es Salaam region. | ca | H | H | H | H | H | H | M |
| M | ir | M | M | H | H | M | M | H |
| | sc | M | M | M | H | M | M | M |
| | rh | H | H | H | H | L | M | H |
| | rm | M | M | H | H | H | M | H |
| | mb | L | M | M | M | L | H | M |
| | tp | M | M | M | H | L | M | M |
| | dm | M | M | H | M | L | M | M |
| | ik | M | H | M | H | L | H | M |
| | jm | L | M | M | M | L | H | M |
| | sm | H | H | M | H | M | H | L |
| N | be | H | H | M | M | L | H | L |
| | et | M | M | H | H | M | H | M |
| | am | H | M | H | M | H | M | H |
| | sm | M | M | L | L | M | M | H |
| | mm | M | M | M | M | M | M | M |
| | ah | M | M | M | M | L | H | L |
| | ka | H | H | M | H | L | H | M |
| | nn | M | H | H | M | L | M | M |
| | mb | H | NR | H | NR | M | NR | H |
| O | ak | M | L | H | M | H | L | H |
| | as | M | M | H | M | H | M | H |
| | ark | H | H | H | M | M | M | H |
| | aa | H | M | H | M | M | M | H |
| | cs | H | H | H | M | H | M | H |
| | dk | M | M | H | M | L | M | H |
| | eka | H | H | M | L | M | M | H |
| | ks | M | M | H | M | M | M | H |
| | mj | H | M | H | M | H | M | H |
| | rs | L | L | H | M | M | M | H |
| Iringa region. | mc | L | L | H | H | L | M | M |
| P | fm | L | L | H | M | H | M | H |
| | hs | M | L | H | H | H | M | H |
| | na | M | M | H | M | M | M | H |
| | rn | L | L | M | M | M | M | H |
| | us | M | M | M | M | M | M | H |
| | tr | M | M | H | H | M | M | H |
| | en | M | L | H | H | M | M | M |
| | ek | H | H | M | M | L | M | H |
| | fb | L | NR | M | NR | M | NR | H |

**Key to codes and symbols used in Table 4.1:**

(i) Assessment sources: **IS**-intelligence survey test questionnaire, **SR**–school report

(ii) Intelligence profile: **H**-high, **M**-Medium and **L**-Low

(iii) **NR** - School reports where not available.

### *4.4.2 Results of the study*

The results that are presented in Table 4.1 indicate a range of strengths and weaknesses in the four intelligences of each learner. Discussion of these results in the following sections will be in terms of (2) the intelligence profile of the learners in general and (2) comparisons between the schools.

#### 4.4.2.1 Logic mathematical intelligence

*(1) Intelligence profile of the learners*

The results of the multiple intelligence survey questionnaire shows that 12 learners are high in logical-mathematical intelligence, 24 learners are medium, and 6 learners are low in this kind of intelligence. This is how they perceived themselves in this intelligence. The learners' performance ability in logical-mathematical as calculated from their school progress report shows that 11 learners are high, 20 are medium and 7 are low. The intelligence profile of the learners shows that most learners who scored high, medium or low in their multiple intelligence survey questionnaire, also scored high, medium and low in their school progress report respectively. The data relating to this intelligence profile is as summarised in figure 4.3 below.

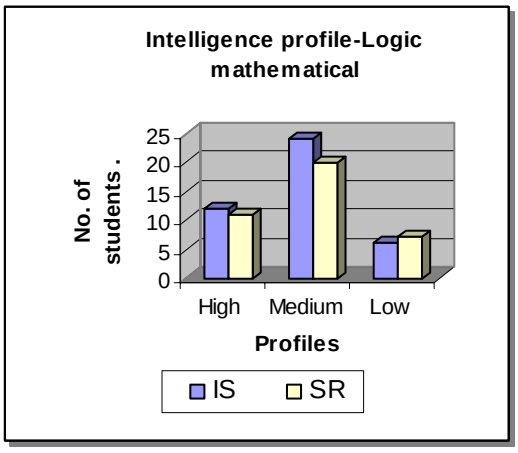



**Figure 4.3:** Intelligence profiles of the learners in logic mathematical intelligence.

*(2) Intelligence profile of the learners between the schools*

A comparison of the intelligence profile between the schools revealed that the performance ability of the learners in schools M, N and O was mostly high and medium compared to School P, where most of the learners' ability in the area of logical-mathematical was low. In three subjects, namely, mathematics, physics and chemistry, the learners in School P had an average score of between 10% and 39% (i.e. below 50%). The findings show that the performance ability of the learners in logical-mathematical intelligence is low.

#### *4.4.2.2 Verbal linguistic intelligence*

*(1) Intelligence profile of the learners*

The learners' intelligence profile distribution as revealed by the multiple intelligence survey questionnaire showed that 24 learners were high in verbal-linguistic ability, 15 were medium, and 1 was low. The school progress report, however, showed that 14 learners were high, 24 were medium, and 2 were low in this form of intelligence. The learners' profile in verbal-linguistic therefore showed that the multiple intelligence survey questionnaire graded more learners as high in verbal-linguistic intelligence even though an analysis in their school progress reports showed that the majority of learners' performances with regard to this form of intelligence is medium. This discrepancy could be explained by the fact that the school progress reports measured a narrow range of intelligences (namely the verbal-linguistic and logical-mathematical). But when one analyses learner ability and performance in terms of in multiple intelligences (even the four here selected), one takes into account a wider spectrum of learners' abilities in the assessment. A consequence of this might be that learner weaknesses in the verbal-linguistic and logical-mathematical could have been compensated for by their relative strength in other measures such as visual-spatial and interpersonal intelligences (which were not factored into the assessment presented in the school progress report). Figure 4.4 shows the summary of the learners' profile in verbal-linguistic intelligence.

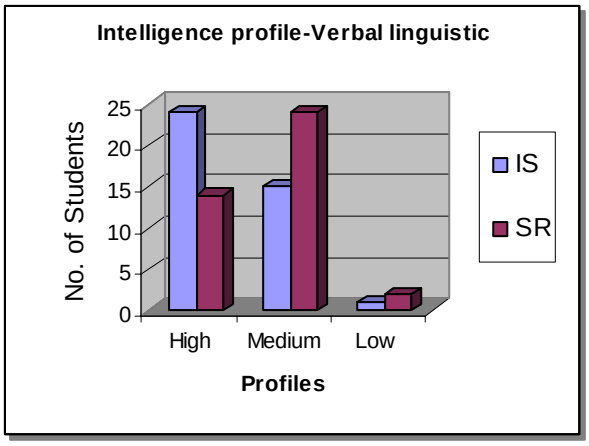



**Figure 4.4:** Intelligence profiles of the learners in verbal linguistic intelligence.

*(2) Intelligence profile of the learners between the schools*

The results of a comparison of the intelligence profile (verbal-linguistic intelligence) between the regions shows that the performance of the learners was almost equally distributed as high, medium and low in all the four schools. None of the learners in school P had a low profile in verbal-linguistic intelligence and none of the learners had a low profile in both instruments.

### *4.4.2.3 Visual spatial intelligence*

*(1) Intelligence profile of the learners*

The multiple intelligence survey test instrument indicates that the intelligence profile of the learners in visual-spatial intelligence are as follows: 9 learners rate as high, 18 rate as medium, and 13 rate as low. The results of the school progress report showed that 9 learners were high in the three relevant subjects (geography, biology and computer studies), 28 were medium and 1 was low. The learner whose average score is medium in their school progress report is also medium in their performance ability according to the multiple intelligence survey questionnaire. Figure 4.5 shows the summary of the learners profile in visual-spatial intelligence.

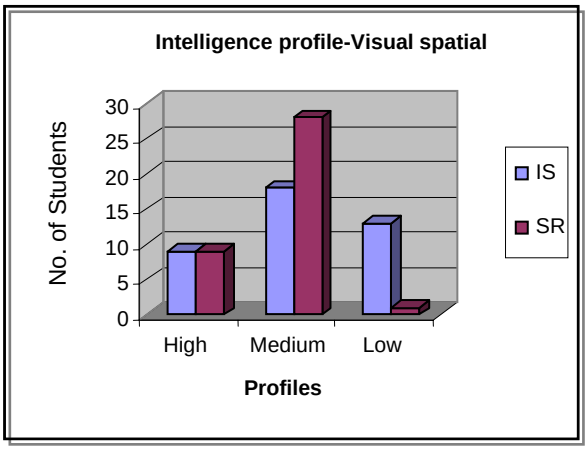



**Figure 4.5:** Intelligence profiles of the learners in visual spatial intelligence.

*(2) Intelligence profile of the learners between the schools*

The results of the intelligence profile (visual-spatial intelligence) between the regions show that Dar es Salaam Region has more learners with high and medium intelligence profiles compared to Iringa Region. Four learners from school P, have low scores from the observation checklist, but have medium scores in their school progress report.

### *4.4.2.4 Interpersonal intelligence*

*(i) Intelligence profile of the learners*

Intelligence profile of the learners in interpersonal intelligence shows that 24 learners were high, 13 were medium and 3 learners were low, according to self-perception of the learners in the multiple intelligence survey test instrument. Learners' interpersonal intelligence profiles according to the observation checklist showed that only 6 learners were high, 23 were medium and 11 were low. Figure 4.6 summarised the learners' profile in interpersonal intelligence.

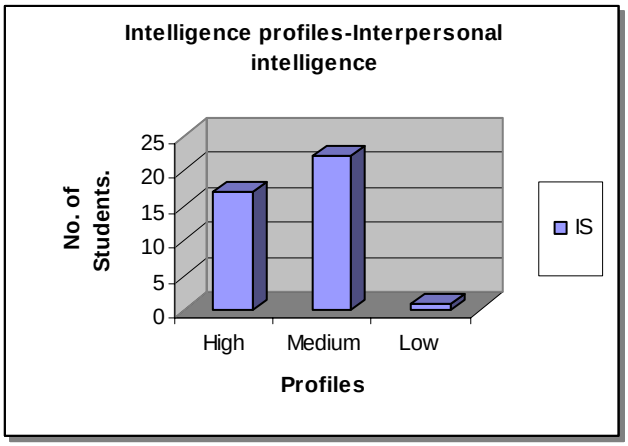



**Figure 4.6:** Intelligence profiles of the learners in interpersonal intelligence.

*(2) Intelligence profile of the learners between the schools*

A comparison of the results of the intelligence profile (interpersonal intelligence) between the regions shows that more learners from Dar es Salaam Region are high in this intelligence. An analysis of the low intelligence profile according to the observation checklist results shows that these 5 learners were from school P. These learners did not like to share ideas with others and would not talk to other learners if they could avoid doing so.

### *4.4.3 Conclusion*

The intelligence profile distribution of the learners in the four intelligences shows that majority of the learners are medium performers except in verbal-linguistic intelligence where majority of the learners are high and medium performers. The results of the school progress report seem to tally with the results of the multiple intelligences survey questionnaire in most cases. Interestingly, some of the learners reported themselves as being high in logical-mathematical intelligence while their performance as rated by the school progress reports and observation checklists rated them as having low scores. Some learners however displayed a consistent fit between their intelligence profiles across all three assessment instruments.

The three instruments that scored the intelligence profile of some learners do in some cases reveal blatant inconsistencies as when, for example, some learners were scored as

being high, low, low ***or*** low, medium, low in different intelligences. For the purpose of this study, I calculated a combined overall intelligence profile for each learner from the three instruments in order to obtain a final judgement score. This meant that if a learner had high, medium and low scores, I combined these to make medium, and so on. But in cases where a learner had consistent scores such as high, high, high, the overall result would obviously be high, and so on. The final judgement of the intelligence profile results of the learners is as shown in Table 4.2. I will now use these results in a discussion of the learners' intelligence profiles as they relate to their performance abilities in the different tasks.

**Table 4.2:** Consolidated results of the intelligence profile of the learners from the multiple intelligence survey test instrument, school progress report and observation checklist

| | | **Final intelligence profiles of the learners** | | | |
|---|---|---|---|---|---|
| **Schools** | **Learners** | **Logic mathematical** | **Verbal linguistic** | **Visual spatial** | **Interpersonal** |
| **M** | ca | H | H | H | L |
| | ir | M | H | M | H |
| | sc | M | M | M | M |
| | rh | M | H | M | H |
| | rm | M | M | M | M |
| | mb | M | M | M | M |
| | tp | M | H | M | M |
| | dm | M | M | M | M |
| | ik | M | H | M | M |
| | jm | M | M | M | H |
| | sm | M | H | M | L |
| **N** | be | M | M | M | M |
| | et | H | H | M | M |
| | am | M | M | H | H |
| | sm | M | M | M | M |
| | mm | M | M | M | M |
| | ah | M | M | M | M |
| | ka | H | H | M | M |
| | nn | M | M | M | M |
| | mb | H | M | M | H |
| **O** | ak | M | H | M | H |
| | as | M | H | H | H |
| | ark | M | M | M | H |
| | aa | M | M | M | H |
| | cs | M | H | M | M |
| | dk | M | M | M | H |

| | | | | | |
|---|---|---|---|---|---|
| | eka | M | M | M | H |
| | ks | M | M | M | H |
| | mj | M | M | M | H |
| | rs | L | M | M | H |
| **P** | mc | L | H | M | M |
| | fm | M | M | H | M |
| | hs | M | H | M | H |
| | na | L | M | M | M |
| | rn | M | M | M | M |
| | us | L | M | M | M |
| | tr | M | H | M | H |
| | en | L | H | M | M |
| | ek | M | M | L | M |
| | fb | M | H | M | H |

**KEY:** H – high, M – Medium, L - Low

## 4.5 The relationship between learners' intelligence profiles and performance in computer application skills

The data collected by the study demonstrated that the learners in the sample had diverse intelligence profiles with varied combined strengths and weaknesses. Two basic assumptions in this study were that most learners will perform in the three open-ended digital learning tasks and in their presentations in a way that corresponds to their intelligence profiles, and that some of the learners will give demonstratable evidence of several intelligences in these tasks and presentations. The discussion below about how these learners gave evidence of their varied performance abilities is based on the researcher's assessment of the three open-ended digital learning tasks and presentations, with reference to computer application skills. The research design also required me to establish whether or not there was any relationship between learners' performances in computer application skills and their intelligence profiles.

I used a contingency table to find out whether there was any significant relationship between the learners' intelligence profiles in logical-mathematical, verbal-linguistic and visual-spatial intelligences and their performance in computer application skills.

### *4.5.1 Assessment of learners' performance abilities in computer application skills in relation to the three intelligences*

I assessed the learners' performance ability to use different computer application skills in relation to their intelligences by using a holistic type of scoring rubric. The assessment criteria that I used to relate computer application skills to logical-mathematical intelligence were:

- A score of 1 (below average) was assigned to any learner who did not use tables or graphs to show ability to record and organise number information.
- A score of 2 (average) was assigned to any learner who used either a table or graph to show ability to record and organise number information.
- A score of 3 (above average) was assigned to any learner who used both tables and graphs to show ability in recording and organising number information.

The other assessment criteria used in the assessment of verbal-linguistic and visual-spatial intelligences can be viewed in appendix 3.9. I then proceeded to assess all the learner's products from the three open-ended digital learning task documents and their PowerPoint presentation documents by using a three-category scoring rubric, namely 1 for below average, 2 for average, and 3 for above average. The numerals assigned match the ascending order of the quality of the performance. The scoring rubric that I used to assess the computer application skills was different from the other scoring rubrics that I used to assess learners' performance abilities in other intelligences. After I had scored all the documents in each task document and PowerPoint presentations, I then calculated an average score for each individual learner. I then grouped the average scores into three competence categories, namely: above average (AA) – 3,3,3 or 3,3,2 or 3,2,2; average (A) 2, 2, 2, or 3,2,1, or 1,2,3; and below average (BA) – 1,1,1 or 1,1,2 or 1,2,2. The results of how each learner performed in each intelligence are summarised in Table 4.3 below.

**Table 4.3:** Learners' performance abilities in computer application skills in terms of the four intelligences

| | | Computer application skills according to intelligences | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Logic mathematical | | | | Visual spatial | | | | Verbal linguistic | | | |
| Schools | Learners | Task 1 | Task 2 | Task 3 | Grade | Task 1 | Task 2 | Task 3 | Grade | Task 1 | Task 2 | Task 3 | Grade |
| **M** | ca | 2 | 3 | 3 | AA | 3 | 3 | 3 | AA | 2 | 3 | 3 | AA |
| | ir | 2 | 2 | 2 | A | 2 | 2 | 1 | BA | 3 | 2 | 3 | AA |
| | sc | 1 | 2 | 2 | BA | 2 | 3 | 1 | A | 2 | 3 | 3 | AA |
| | rh | 1 | 2 | 2 | BA | 2 | 3 | 1 | A | 2 | 3 | 3 | AA |
| | rm | 1 | 1 | 1 | BA | 2 | 1 | 1 | BA | 3 | 2 | 2 | AA |
| | mb | 1 | 1 | 2 | BA | 1 | 3 | 2 | A | 2 | 3 | 2 | AA |
| | tp | 2 | 2 | 3 | AA | 3 | 3 | 2 | AA | 2 | 3 | 3 | AA |
| | dm | 2 | 3 | 2 | AA | 1 | 2 | 2 | BA | 3 | 3 | 2 | AA |
| | ik | 2 | 3 | 2 | AA | 1 | 2 | 2 | BA | 3 | 3 | 2 | AA |
| | jm | 1 | 1 | 2 | BA | 1 | 3 | 2 | A | 2 | 3 | 2 | AA |
| | sm | 2 | 2 | 3 | AA | 3 | 3 | 2 | AA | 2 | 3 | 3 | AA |
| **N** | be | 3 | 2 | 2 | AA | 1 | 1 | 1 | BA | 1 | 2 | 2 | BA |
| | et | 3 | 2 | 3 | AA | 1 | 3 | 2 | A | 3 | 2 | 3 | AA |
| | am | 1 | 1 | 1 | BA | 2 | 3 | 3 | AA | 1 | 2 | 2 | BA |
| | sm | 1 | 2 | 2 | BA | 1 | 3 | 2 | A | 1 | 2 | 2 | BA |
| | mm | 1 | 1 | 2 | BA | 1 | 1 | 1 | BA | 1 | 1 | 1 | BA |
| | ah | 1 | 1 | 2 | BA | 1 | 2 | 2 | BA | 1 | 1 | 1 | BA |
| | ka | 1 | 2 | 2 | BA | 1 | 2 | 3 | A | 3 | 2 | 3 | AA |
| | nn | 1 | 1 | 2 | BA | 1 | 2 | 2 | BA | 1 | 1 | 1 | BA |
| | mb | 2 | 3 | 3 | AA | 1 | 2 | 3 | A | 1 | 2 | 2 | BA |
| **O** | ak | 2 | 2 | 2 | A | 2 | 3 | 3 | AA | 3 | 3 | 2 | AA |
| | as | 2 | 2 | 2 | A | 2 | 3 | 3 | AA | 3 | 3 | 2 | AA |
| | ark | 1 | 1 | 2 | BA | 2 | 1 | 1 | BA | 3 | 2 | 3 | AA |
| | aa | 3 | 2 | 3 | AA | 2 | 3 | 2 | AA | 2 | 2 | 2 | A |
| | cs | 2 | 1 | 2 | BA | 2 | 1 | 2 | BA | 3 | 2 | 3 | AA |
| | dk | 1 | 1 | 2 | BA | 1 | 1 | 1 | BA | 2 | 2 | 2 | A |
| | eka | 2 | 1 | 2 | BA | 2 | 2 | 1 | BA | 2 | 2 | 2 | A |
| | ks | 1 | 1 | 2 | BA | 2 | 2 | 1 | BA | 2 | 2 | 2 | A |
| | mj | 3 | 2 | 3 | AA | 2 | 2 | 2 | A | 2 | 3 | 3 | AA |
| | rs | 2 | 1 | 2 | BA | 2 | 1 | 2 | BA | 2 | 1 | 3 | A |
| **P** | mc | 1 | 1 | 2 | BA | 1 | 1 | 1 | BA | 2 | 2 | 2 | A |
| | fm | 1 | 2 | 2 | BA | 1 | 2 | 2 | BA | 1 | 3 | 2 | A |
| | ha | 1 | 1 | 2 | BA | 1 | 1 | 2 | BA | 3 | 2 | 2 | AA |
| | na | 1 | 1 | 2 | BA | 1 | 1 | 1 | BA | 1 | 1 | 2 | BA |
| | rn | 1 | 1 | 1 | BA | 1 | 1 | 1 | BA | 1 | 2 | 1 | BA |
| | us | 1 | 2 | 1 | BA | 1 | 1 | 1 | BA | 1 | 2 | 2 | BA |
| | tr | 1 | 1 | 1 | BA | 1 | 2 | 2 | BA | 1 | 2 | 2 | BA |
| | en | 1 | 1 | 2 | BA | 1 | 2 | 1 | BA | 2 | 2 | 2 | A |
| | ek | 1 | 1 | 2 | BA | 1 | 2 | 1 | BA | 1 | 2 | 2 | BA |
| | fb | 2 | 2 | 2 | A | 2 | 3 | 3 | AA | 2 | 3 | 3 | AA |

**KEY:** BA – Below Average, A – Average, and AA – Above Average.

Performance ability in computer application skills was found to be on ***average*** for most learners. The learners in the sample, as I noted earlier in the text, participated in this study partly because they were already taking a computer course in their schools. These results were not therefore surprising. However, when the learners' performance ability in computer application skills was assessed in terms of the criteria selected for the four intelligences, a large number of variations became apparent.

#### *4.5.1.1 Recording, organizing and using number information (logic mathematical intelligence)*

The performance ability of the learners in computer applications (i.e. their ability to record and organize number information and make a logical arrangement of their text document) was generally below average. Thus, for example, only ten learners performed above average in this field because they were able to use two computer programs (Microsoft Excel and Word) to draw graphs and tables in order to record and organize their number information. These same learners also demonstrated that they could use the features of Microsoft Word in an effective way to arrange and format their text document in a logical way. Thus they tended to **bold** subtitles and cross heads and set them in a different font size, and to arrange their text into logical paragraph units that expressed logical deduction and a superior understanding of the logical transitions from one element of text to another. These same learners also frequently used number information creatively in their text to emphasize a point, and in many cases also added some of this information to their presentation slides.

The performance ability of four learners was average because they managed only to use one computer program to create and organise their documents and slides. Thus they used either a table ***or*** a graph (but not both) to record and organize their number information in their tasks. They also used number information sparingly in both their texts and their presentation slides.

At the bottom of the rating schedule were 26 learners who were rated as performing in below average way. This meant that they did not use any other computer applications to help them to record and organize their number information in the form of tables and graphs in either their Microsoft Word documents or in their presentation slides. They used Microsoft Word to type their text in (usually) one or two paragraphs but they did not indicate subtitles or in any other way reflect logical thinking or understanding in the arrangement of their texts or presentations. Generally speaking, these learners used no other computer application skill apart from Microsoft Word to type their texts.

#### *4.5.1.2 Visual application skills – pictures, clip art, colours, tables and graphs, font size and style (visual spatial intelligence)*

The learners in the sample represented visual information by using different computer application skills in Microsoft Word and PowerPoint. Eight learners were rated above average in this category because they managed to use pictures from clip art, photographs from the reading resources (to emphasize a point), word art and different font colours (for decoration), bolded fonts and lines to underline their titles and subtitles (for emphasis), and tables and graphs (for organizing number information) in their Microsoft Word text documents. They also used animations in their PowerPoint presentations.

Nine learners were rated as average in computer application skills because they managed to use only one computer application skill for the visual representation of information in their texts and PowerPoint slides. They only used pictures from clip art and pictures from their reading resources to the exclusion of other possibilities. Twenty-three learners were rated as below average because they did not use any visual application skills in their Microsoft Word texts or in their PowerPoint presentation slides in all of the three tasks.

#### *4.5.1.3 Organization of ideas – paragraphs, bullets, and columns (verbal linguistic)*

An analysis of the performance abilities that indicated verbal-linguistic intelligence showed that most learners performed either in an above average or in an average way in the completion of the tasks. A total of 20 learners were rated as above average out of a

total group of 40 learners. These learners used paragraphs and bullets to organize their ideas in their text documents in a way that conferred a greater degree of coherence and logical organisation on their texts and presentations. One group of learners used columns to format their document and made a flyer by using the resources of Microsoft Word (see Figure 4.1). And another group prepared a poem as an educational strategy for their community (see text on appendix 4.1).

Most learners seemed to be comfortable with using Microsoft Word programme compared to other programmes in the study. This might indicate that these features are routinely taught in the kind of computer courses that are presented in Tanzanian schools. For example, these learners tended on the whole to use Microsoft Word to type their documents and divide them into logical paragraphs, as well as features of Microsoft Word such as Spell Check. (Their use of Spell Check reduced the incidence of spelling mistakes). None of them needed any supplementary help from the researcher to manipulate this programme.

On the other hand 12 learners scored below average in computer application skills in this category. The text documents they typed were less organized, some of the learners had one big typed paragraph and all the information was collectively in this text. Some of the learners even needed help on how to open the programme, and use of other application skills like bold, underline and saving the document on a floppy disk. This was a big challenge for them especially when everyone was supposed to complete the given open-ended digital learning tasks. However, 8 learners were average performers who managed to use the Microsoft Word programme with very little help from the researcher.

Most learners obviously felt comfortable and sufficiently skilled to use Microsoft Word to type their text. This is because the computer course syllabus for Tanzanian secondary schools emphasises training in basic skills, and that means being able to use the features of Microsoft Word with a degree of facility. It is evident that most of the learners in the sample have mastered at least the most basic computer application skills recommended by the Tanzanian syllabus. That much is evident from their facility in using these basic

functions and features. One might also make the deduction that if they had further opportunities to learn, explore, practise and experiment, they could extend their repertoire of skills and knowledge and integrate and apply those skills and that knowledge in new situations. They have a sound basic knowledge of how to use Microsoft Word programme. But they urgently need at least some skill and facility in the use of other Microsoft Word features such as Microsoft Excel and PowerPoint.

In the following section, I will establish whether there is a *significant* relationship between the learners' four intelligences profile (strengths and weaknesses) and their performance abilities in computer application skills.

### *4.5.2 The possibility of a relationship between learners' intelligence profile and computer application skills in terms of four intelligences*

I utilised a contingency table to determine whether there was a relationship between the learners' intelligences profiles (their strengths and weaknesses) and their performance abilities in computer application skills. I prepared this contingency table by using data from: (1) the results of the final judgement results of the intelligence profile of the learners recorded in Table 4.2, and (2) the assessment results of the learners' performance abilities in computer application skills in different intelligences (as recorded in Table 4.3).

I then proceeded to use a descriptive data analysis procedure. I judged this procedure to be appropriate because of the small sample size and purposive sampling process used for the learners who participated in the study. These limitations *disallow the use* of *a chi-square statistical test*. A chi-square test moreover requires at least 80% of the cells of a contingency table to contain at least five cases if a confidence level is to be obtained from the results (Cohen, Manion, & Morrison, 2000). In this case, some of the cells in the contingency table contain fewer than five cases or none at all. The distribution of learners in the contingency table is as seen Table 4.4.

**Table 4.4:** Distribution of learners in each intelligence profile (logical-mathematical, visual-spatial and verbal-linguistic) and their performance abilities in computer application skills

| Computer skills ↓ | Intelligence profiles of the learners | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Logic mathematical | | | | Visual spatial | | | | Verbal linguistic | | | |
| | H | M | L | Total | H | M | L | Total | H | M | L | Total |
| Above average | 4 | 6 | -- | 10 | 3 | 5 | -- | 8 | 13 | 7 | -- | 20 |
| Average | -- | 4 | -- | 4 | -- | 9 | -- | 9 | 2 | 6 | -- | 8 |
| Below average | -- | 21 | 5 | 26 | 1 | 21 | 1 | 23 | 1 | 11 | -- | 12 |
| Total | 4 | 31 | 5 | 40 | 4 | 35 | 1 | 40 | 16 | 24 | -- | 40 |

**KEY: H** – high, **M** – Medium, **L** - Low

The distribution of learners in the contingency Table 4.4 reveals a distinct pattern that suggests a relationship between learners' intelligence profile in the different intelligences and their performance abilities in computer application skills. A number of learners showed that their performance abilities in computer application skills related to their intelligence profile (their strengths and weaknesses) in logical-mathematical, visual-spatial and verbal-linguistic intelligences. I shall discuss at length the overall performance abilities of the learners and their intelligence profiles in the following sections.

### 4.5.2.1 High/low profiles in logic mathematical intelligence and computer application skills

Four learners who rated high in their logical-mathematical profile managed to perform in an *above average* way in their computer application skills in the three tasks. These learners organised and planned their data skilfully and logically, and they recorded and organized their number information in tables by using the table feature of Microsoft Word and the graphs feature of Microsoft Excel. This subset of learners used numbers creatively and imaginatively to supplement their explanations and presentations because they referred to numerical information from graphs and tables in their text documents. On the other hand, the five learners whose intelligence profile was low in logical-

mathematical intelligence, also performed in a *below average* way in their computer application skills in the three tasks. These learners did not use tables from the table feature of Microsoft Word or graphs from Microsoft Excel to organize and record their numerical information as they processed the data that they had to present to their peers. Moreover they did not sequence the content part of their texts well by using paragraphs or other indicators of logical division and presentation although the paragraph is a fundamental feature of Microsoft Word text presentation. They organised the logical division of their texts by sequentially presenting examples that they obtained from the reading resources – but without reflecting logical transitions in the layout of their text and presentations.

The middle group of four learners, who had been assessed as having a medium intelligence profile, also scored an *average* rating in computer application skills. These learners used a minimum of computer applications in their tasks. They included *either* a table or a graph (but not both) in the organization of the numerical information of their texts and presentation. Some of them sequenced their information into paragraphs in Word, and some used numbers to organise their texts logically and clearly.

The group of 27 learners who were rated as having medium intelligence constituted the majority of the sample, with six learners who scored above *average* in their computer application skills while the remaining 21 learners scored *below average* in their computer application skills.

#### 4.5.2.2 High/low profile in visual spatial intelligence and computer application skills

Out of the four learners with high intelligence profile in visual-spatial intelligence, three managed to obtain an *above average* rating in their computer applications skills in the three tasks. These learners demonstrated their visual-spatial intelligence skills by using pictures from clip art, Word art and photographs from their reading resources. In some of the tasks, these learners used tables and graphs from Microsoft Word and Excel to decorate their texts and presentations. These learners also used colours to lend point to their fonts, and substituted attractive and appropriate fonts for the standard Times New

Roman from the selection in Word to add interest to their tasks. Other computer features that they used in their texts included bolding and underlining their headings and subheadings. They also successfully managed to use animations in their PowerPoint presentations.

The nine learners who had medium intelligence profiles scored an *average* rating in their computer application skills. These learners used either a table or a graph, and used only one kind of picture feature in their presentations. That is to say, they used either clip art or photographs from their reading resources in their presentations (but not both). They also used other computer features such as underline while some changed the font styles in their texts. Some of them also managed to include animations in their PowerPoint presentations.

One learner with a low intelligence profile in visual-spatial intelligence performed in a below *average* way in computer application skills. This learner did not give any evidence of visual skills in the completion of his tasks. He did not use pictures from any of the programmes like clip art, Word art or any pictures from the reading resources that were provided. He also did not use tables or graphs, or any colours or variation in font size or style to embellish any point in the tasks. Nor did he use animation in his PowerPoint presentation of slides. All that this learner basically managed to do was to type a text by using Microsoft Word, Times New Roman (12) and nothing else. He did not supplement his presentation by using any of the most basic Word features such as underline, bold and or varying font size.

Five learners out of this group scored *above average* in their computer application skills in the three tasks although they were rated as having a medium intelligence profile. In addition, 21 learners who were rated as having a medium intelligence profile in visual-spatial intelligence scored *below average* in their computer application skills.

#### 4.5.2.3 High/low profile in verbal linguistic intelligence and computer application skills

Thirteen learners who were rated as giving a high intelligence profile in verbal-linguistic intelligence scored *above average* in their performance ability in computer application skills in all the three tasks. In general, these learners used Microsoft Word to type their ideas. They organised their narratives in themes that they divided coherently into sub-themes. A pair of learners from school M, for example, used their verbal skills to invent rhymes to make a point about diseases in task 1. They wrote a poem as part of their strategy to educate people in their campaign against to make people in the community aware of the dangers of typhoid fever. They also divided their texts into logical and coherent paragraphs.

Six learners who were rated as having medium intelligence profiles in verbal-linguistic intelligence produced medium performances in their computer application skills. Most of these learners managed to use Microsoft Word to type their texts, and some were also able to set their presentation into a narrative form and to use bullets effectively to emphasise some of the points that they had obtained from the reading resources. Finally, since there was no learner in this group who had been rated as having a low verbal-linguistic profile, and no one performed in a below average way to express this intelligence, no possible link could be made in this regard.

However, within the group of 16 learners who had been rated as having a medium intelligence profile, seven performed in an *above average* way in the in computer application skills, and 11 performed in a *below average* way in all three of the tasks.

### *4.5.3 Conclusion*

The results of the study show that there was a distinct pattern of performance abilities that emerged from the data. Every learner exhibited both strengths and weaknesses in each intelligence category rather than a uniform level of ability in all or any of the intelligence categories. The contingency Table 4.4 indicates that a positive relationship exists between learners' intelligence profiles and their performance abilities in computer application skills (as the shading in the contingency Table 4.4 emphasises). A good

number of learners who had high intelligence profiles also produced *above average* performances, while learners whose intelligence profiles were low also produced *below average* performances in their computer application skills in all three of the tasks.

Some of the learners who had been rated as having medium intelligence profiles also produced *average* performances in their computer application skills in all three tasks given. The findings of this study show that learners' intelligence profiles do have an influence on their preferences and performance abilities in different tasks. The assessment results of the three tasks showed that the performance abilities that learners exhibited in the computer application skills were also unique to individual learners. For example, in visual-spatial intelligence, learners who had been rated with *high* intelligence profiles used various pictures, images and clip art pictures to express themselves even though all the learners were required to complete the same tasks under the same conditions and with the same limitations. Some of them also used manila sheets to complete some of the drawings that they needed to complete the tasks. But learners who had been rated as having low visual-spatial intelligences used sometimes only one or two pictures from the clip art – or did not use any at all. They also did not use the manila sheets to complete their tasks.

If one looks at the tasks that the learners had to complete and does not focus only on the skills that are useful in the school context, one can see that the open-ended digital learning tasks gave learners an opportunity to use different learning preferences to attain significant and rewarding outcomes in their tasks. Thus, for example, learners used different computer preferences to complete their task documents and their slide presentations, and they integrated computer application skills (Microsoft Excel and PowerPoint) that were new to them to complete their tasks. They also made use of – and benefited from – the collaborative learning format of the research. These enriching activities could not have been experienced if the learners had been given standardized tests and had been required merely to provide answers to the questions asked.

However easy or difficult it might have been for individual learners to complete these authentic tasks, some learners gave evidence of appreciating how difficult it is to address complex issues that occur in real life (authentic) situations. But these learners nearly all appeared to enjoy their tasks. Some came up with provocative and original ideas during the presentations session and these prompted interesting class discussions. Many of the learned skills that the learners acquired may also be transferred to other courses and work situations. In this study, for example, the real world activities that the researcher selected ensured that learners would be likely to use the computer skills that they had become proficient in their tasks and that they might even aspire to learn new and valuable skills during the process.

The use of computers to complete open-ended digital learning tasks not only captured the learners' attention; it also highlighted differences in learners' performance abilities on the basis of different intelligences. Thus, for example, one of the learners out of the whole group performed exceptionally well. His name was Coleman (a pseudonym). Coleman's intelligence profile was high in logical-mathematical, verbal-linguistic and visual-spatial intelligences, and he also performed in an *above average* way in all the three tasks across all the three intelligences. But in interpersonal intelligence, Coleman had a medium profile and his performance was also medium in all the three tasks.

In order to describe what I, the researcher, and the co-observant teachers observed and assessed in each activity as vividly as possible, I reconstructed the results from each of the open-ended digital learning tasks and presentations into ***stories***. These stories are about four learners who were consistently rated highly in performance abilities in visual-spatial, logical-mathematical, verbal-linguistic and interpersonal intelligences. The first story, for example, is about Coleman. Coleman gave evidence of an unusual competence by consistently being rated highly in logical-mathematical, verbal-linguistic and visual-spatial intelligences although he was rated low in interpersonal intelligence. The following story is about Rachael who was rated highly in verbal-linguistic intelligence but low in other intelligences. Next is about Abigail who was rated highly in interpersonal intelligence, and, finally, there is Kim, who was rated highly in visual-

spatial intelligence but low in the other three intelligences. I present these narratives or stories in the sections that follow.

## 4.6 Learners' intelligence profiles, preferences and performance abilities in four intelligences across the tasks

The intelligences profiles that I described in the earlier part of this research helped to explain the overall strengths and weaknesses that learners displayed in the four intelligences selected as the basis for this research, namely logical-mathematical, verbal-linguistic, visual-spatial and interpersonal intelligences. These profiles showed that while some learners demonstrated high intelligence in some categories of intelligence, they demonstrated lower intelligence scores in others categories of intelligence. For the purposes of this research, I used the information that I obtained from observing how learners completed the open-ended digital learning task documents and their presentations to complement and confirm the picture presented by the intelligence profiles that I obtained from the other named sources.

I thus found that learners who were strong in logical-mathematical and visual-spatial intelligences also completed the required tasks in a way that demonstrated that they possessed above-average logical-mathematical and visual-spatial intelligences. The results from the intelligence profiles tables and contingency tables however did not give me any detailed (layered) information about how each individual learner managed to use the four intelligences, in different combinations to complete their tasks in the form of task documents, presentation slides, discussions and manila sheets.

The following sections give a detailed description of how the following selected learners have shown to possess high logical-mathematical, visual-spatial, verbal-linguistic and interpersonal intelligences from the two separate sources described above have performed in each task.

I made use of four stories to show how this subset of learners made certain important choices to complete their tasks. I only selected the four stories after the tasks had been scored by myself and by the teacher, and after I had evaluated the intelligence profiles of

all the learners so that I could define the subset of learners in whom I was interested in. I was anxious to establish whether any patterns might consistently emerge in the performance abilities and choices demonstrated by these learners in the three different tasks, and in the way that they solved the open-ended digital learning tasks and fashioned their products (The names of the learners used in this section are pseudonyms).

As one may expect from a group of this kind, the dominant intelligence(s) of the learners was shown in their actions, choices, techniques and instinctive preference for one particular mode of operation. Thus, for example one group of learners showed a consistent preference for using numbers, graphs and tables (an indication of logical-mathematical intelligence); another group of learners showed or decided on a preference for using pictures, clip art, colours and different font sizes (an indication of visual-spatial intelligence); another group of learners showed a marked preference for detailed verbal explanations in text documents generated by Microsoft Word (an indication of verbal-linguistic intelligence); another group of learners showed a noticeable preference for helping their peers to use computer applications and for leading and stimulating discussions in their teams (an indication of interpersonal intelligence). The intelligences and performance abilities that were used in the assessment of the documents are summarized in Table 4.5 below.

**Table 4.5:** Intelligences and performance responses

| Intelligence | Responses to tasks |
|---|---|
| Verbal linguistic – | Uses own words to express themselves in the texts, contributes to discussions, like reading, talks a lot, describes a procedure. |
| Logic mathematical – | Uses numbers, summarizes number information in graphs and tables, put things into categories, uses spread sheets, and databases, logic sequencing of information. |
| Visual spatial – | Can draw images and pictures. Use charts, diagrams, clip art and word art. Like to use colours. |
| Interpersonal – | Like to organize, relate, manipulate, and mediate with people. Like to provide help, have friends and like to and can assign roles to others. |

In his theory of multiple intelligences, Gardner (1983; 1993) argues that while all average people are capable of drawing on all the intelligences, individuals are distinguished by their particular profile of intelligences, that is, **by their consistent preference for utilising one or more of their stronger intelligences.** This profile of consistently chosen preferences identifies the learner's own unique combination of relatively strong intelligences to which they instinctively resort to solve problems or fashion their products (Walters & Gardner, 1985). I shall use this concept of the relative strength or weakness of specific intelligences to account for the individual differences that the learners displayed in the context of the following stories (Gardner, Kornhaber, & Wake, 1996).

The stories of these learners were compiled from data collected during the observation and assessment of their performance abilities as it was presented in their open-ended digital learning task documents and presentations. My observations were guided by the use of rubrics. I gathered other data and information from the interviews that I conducted with the learners, teachers and their parents.

### *4.6.1 Story 1: Strong in logic mathematical, visual spatial and verbal linguistic intelligences*

This is a story about Coleman who was 16 years old and in Form 2. He exhibited an unusually high competence in more than one of the intelligences. His quite noticeable preferences as he worked on the open-ended digital learning tasks and presentation session were for using his logical-mathematical, verbal-linguistic and visual-spatial intelligences. He was nevertheless quite weak in interpersonal intelligence. The following sections present a detailed discussion of how Coleman performed in all of the three open-ended digital learning tasks.

#### 4.6.1.1 Logical-mathematical

According to Gardner (1983; 1996) and Chapman (1993), strong performance abilities in logical-mathematical intelligence are evident in learners who enjoy using calculations, problem solving, critical thinking, data interpretation and categorizing facts. While such learner enjoy using technology (computers), they also like to use spreadsheets to give shape to their results, and they show a marked preference for summarizing number

information in the form of tables and graphs. They also prefer to identify and collate logical and numerical patterns in data and information in order to explore patterns and relationships.

Coleman's performance ability in logical-mathematical intelligence, compared to the performance ability of other learners, was impressive indeed. In all of the three tasks, Coleman scored three points. This means that his performance ability is above average in logical-mathematical intelligence. Let us look at how Coleman performed in task 1. Task 1, this is the activity that required learners to prepare an educational strategy that would educate their community about two extremely dangerous water-borne diseases, *Cholera* and *Typhoid fever*. They were asked to prepare a flyer, a radio or television programme, or a poem.

Coleman selected a television programme and typhoid fever disease. First, he summarized all the information he felt would be relevant and typed it in a Word document. He then logically arranged this information in short paragraphs that showed what is typhoid fever, the name of the microbe that transmits the disease, how the disease is transmitted, the symptoms, treatments, prevention, and finally the implications to the community and the government if the disease is not treated on time. Apart from summarizing his work logically, Coleman selectively used numbers in a consistent way in his text, so that more emphasis would be placed on the effects of the disease to human life. He then provided official statistics about the number of people who were infected and died from typhoid fever disease annually in the whole world during a certain time frame. These are the words he used to convey this. This extract also shows how he used numbers in the text to make his point:

> The annual occurrence of typhoid fever is estimated at 17 million cases, with approximately 600,000 deaths annually world wide. Typhoid fever is a global health problem affecting an estimated 12.5 million people annually and is endemic in many countries, particularly those in Asia, **Africa,** and South America.

During the interview session, when I asked Coleman why he had used the information quoted above for his television programme, he said, "I had to put more emphasis on the disease by telling people how this disease can be dangerous. [I did this] by indicating the number of people who have been affected and died. And hence people in the community should not take it lightly. They have to be aware that it has affected many people world wide. They have to know that."

In task 2 – landfills and its effects to the environment, Coleman also inserted the following relevant numerical information (data) into his text:

> Dar es Salaam city has a population of 3.5 million people and produces 2,000 tonnes of garbage per day. 20% of this is collected compared to some of the cities in New Zealand where about 90% of the garbage is collected per day.

Coleman showed a marked preference for using numbers to emphasize points. He said in the interview that it was important for him to use numbers in his educational strategy to educate his community. People, he said, understand more easily when one uses information with numbers to explain the severity or the impact of a disease.

The results from the tasks also showed that Coleman performed well in categorizing numbers. Thus, for example, he used tables to display his information in a summarized form by using Microsoft Word (see Table 4.5) and graphs using Microsoft Excel (see Figure 4.7 below). This graph by Coleman (below) summarizes information to show various ferry disasters that occurred in different countries (as indicated in reading resources for task 3), and the number of people who died over three years in such disasters. During the presentation session, Coleman used this table and the graph to discuss with his peers how ferry disasters had also affected other countries and how these disasters could be compared with those that had occurred in Tanzania.

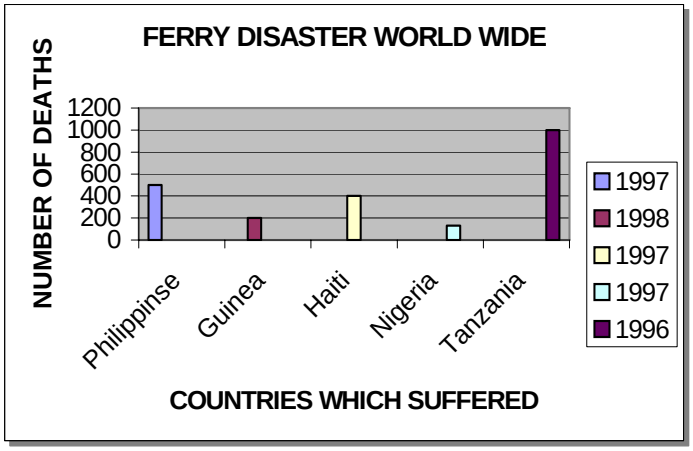



**Figure 4.7:** The graph used by Coleman to show the incidence of ferry disasters worldwide over a period of three years.

Coleman also thought of a way of conveying information from other parts of the world and relating it to the local context by logically arranging the information that he wanted to convey. After he had done this, Coleman said he felt that he had managed to summarize the information to the level that could be understood by the members of his community. From his graph, the people of his community would see that Tanzania had suffered most by losing more that 1000 people in the MV Bukoba tragedy that occurred in 1996, compared to those in the Philippines and Haiti.

**Table 4.6:** The table used by Coleman to illustrate the details of the MV Bukoba tragedy

| MV Bukoba Tragedy | | | | | |
|---|---|---|---|---|---|
| **Survivors** | **Trapped** | **Rescued** | **Lost completely** | **Tanzanians** | **Ugandans** |
| 125 | 522 | 158 | 500+ | 1,000+ | 10 |

Coleman's strong performance ability in logical-mathematical intelligence was also supported by his academic results in the school progress report. Coleman scored 72% as his average score in mathematics, physics, and chemistry subject. This shows that he has an exceptional ability to work with numbers and an ability to work logically in mathematics and science subjects. In self-rating multiple intelligence survey questionnaire, Coleman rated himself as being strong in logical-mathematical and gave himself a score of 9/10. This suggests that he is well above average in logic-mathematical intelligence.

#### 4.6.1.2 Visual spatial intelligence

According to Gardner (1983; 1996) and Chapman (1993), visual-spatial intelligence is the learner's capacity to perceive and create visual experiences. It may be seen in the imaginative and creative use of photographs, pictures, visual strategies and images. It also indicates an ability to use different media to produce and exploit the potential of graphics, designs and colours.

Coleman's performance in the area of visual creativity was also impressive in this context. In my first encounter with Coleman during the pre-session discussion about the study, Coleman introduced himself, and talked about what he would like to do in the future. He said he would like to be a pilot one day and that he would like to be able to observe the world from the sky. What was most striking about Coleman as he worked on the open-ended digital learning tasks was the way in which he combined different media – in this case, computers (electronic media) and manila sheets (paper-based media) – to construct his pictorial representations. Although all the learners were required to use the computers in one way or another, Coleman used different computer applications including the pictures from reading resources, photographs from clip art, and tables and graphs that he constructed by using features from Microsoft Word and Microsoft Excel respectively.

Coleman showed good judgement in his selection of pictures and photographs to represent his visual ideas as he completed his tasks on the computer. In task 1 (diseases),

for example, he selected a certain picture to show that certain types of microbes caused typhoid fever (Figure 8), in another picture it showed one possible way in which a microbe can be transferred or transmitted to another person (Figure 9), and another one to show the effects of this disease on the daily lives of the people (severe and often terminal illness) (Figure 10). What Coleman wanted to convey by using these visual effects was the logical narration of how a disease can spread and how it can affect people *sequentially*. This was the information that Coleman felt was vitally important, and he wanted to use it in his educational strategy. During my interview session with Coleman, he said that he had used pictures because he had to consider the limitations in the educational level of the people living in his community. He said:

> I know some of the people in my community will not understand the whole text I have used [...] Adding pictures is one way of simplifying the information. People understand easily when they visualize the information by using pictures. […] Pictures show real situations. […] Like the picture I used showing people standing in the water: it represents the real situation out there.

(i). Pictures Coleman used in Task 1: Health and Diseases.

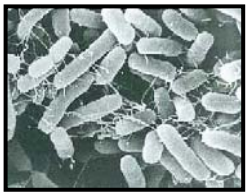


Figure 8-microbes


Figure 9- transmission

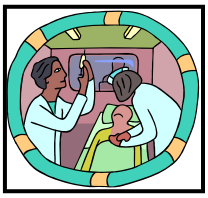


Figure 10 – a sick person.

For task 2, Coleman selected several pictures that showed the stages through which garbage passes from collection to disposal in landfills. The first one showed garbage being collected from a household (Figure 11). The second shows a garbage collection truck emptying garbage into an officially designated landfill area (Figure 12). The final one shows a household that is surrounded by garbage and dirty water (Figure 13).

(ii) Pictures Coleman selected for Task 2: Landfills and its effects on the environment.


Figure 11 – Collection


Figure 12 – emptying in landfills


Figure 13 –filthy place.

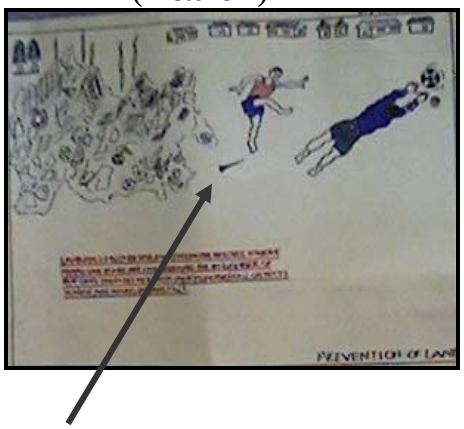
Apart from making an intelligent selection from and an effective use of the pictures that were part of the clip art and photographs in the reading resources provided, Coleman also used pencils and marker pens to create a poster on one of the manila sheets provided. He told me that the poster formed part of the educational strategy that he had devised for his community. His poster summarized information about how landfills can affect a community in different ways. (Landfills that are not properly planned or maintained can pose serious health hazards to people who live near them. But local authorities can take advantage of landfills by recycling certain waste products for a profit).

Coleman described how members of the community could be seriously affected by these often fatal diseases. His picture 1, for example, shows one of the ways in which a landfill can be dangerous. It depicts sharp rusted instruments such as nails that can injure the children who play in these landfills. A child hurt by an infective agent such as a nail could develop tetanus poisoning (an often fatal condition). In his second picture, Coleman shows the fumes, smoke and foul odours that landfills emit. The fumes and often toxic smoke from landfill sources can precipitate chest conditions such as bronchitis and other related diseases in children – or worse. Landfills are often sources of heavy metal compounds that are released into the atmosphere as fumes or smoke. Some of these heavy metal compounds deposit themselves in the human body and cause severe and often irreversible long-term heath problems (such as foetal deformities) and even premature human fatalities. In his third picture, Coleman suggests ways in which the government can recycle, for example, empty cold drink cans to obtain aluminium which, in turn, can be used to produce useful household items such as cutlery.

All Coleman's drawings show a creative use of colour (see, for example, Figure 4.14). Coleman's skilfully detailed drawings showed an intelligent awareness of the possible effects of landfills on the environment and the hazards that these can be posed to human beings who lived in their proximity.

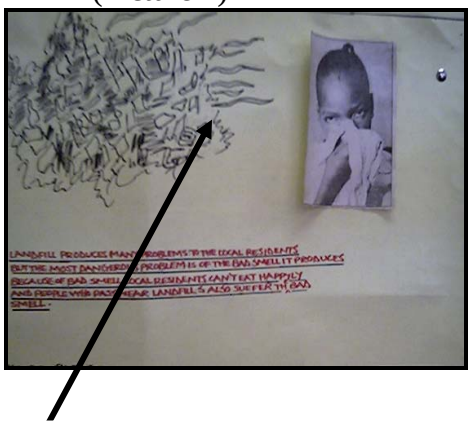
**Health hazards that can be caused by landfills**

(Picture 1)



Two young boys are playing near a landfill. In the landfill are some dangerous objects such as rusted nails. These nails can puncture the skin and cause a fatal disease such as tetanus.

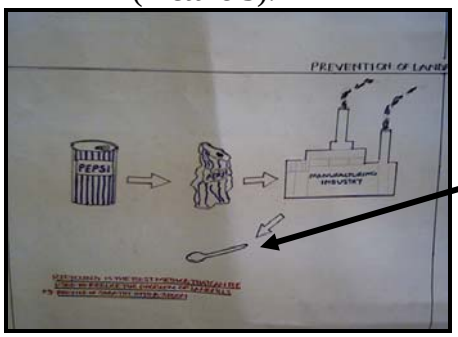
(Picture 2)



Landfills often produce poisonous smoke and noxious odours that can precipitate asthma, bronchitis and other severe respiratory diseases in humans. The picture shows a woman suffering from the effects of the foul-smelling chemical fumes and smoke that are being emitted by slow-burning toxins in a nearby landfill.

**Recycling process to reduce landfills effects**

(Picture 3).




In this picture Coleman shows how aluminium cans can be recycled to decrease waste-disposal volumes and provide a source of recycled aluminium.

Pepsi tins, for example, may be collected and returned to a factory where they can be reprocessed to produce aluminium that can be used to produce spoons, for example.

**Figure 4.14:** Drawings done by Coleman to depict the potential health hazards posed by landfills

For task 3, the learners were asked to write a story about the MV Bukoba Tragedy, which claimed more than 1,000 lives. Coleman, however, used his initiative and visual imagination to write a story which he then illustrated by a picture of a sinking ship (Figure 15). During the interviews Coleman said:

> I did not know that the people who lost their lives in the MV Bukoba tragedy. [They must have] died in a painful manner. [They] could not be rescued in time before they died. Moreover, most of the bodies could not be retrieved for burial […] It was sad for their families.

He included a slide in his presentation that showed a person crying in agony. He illustrated it by saying, "Maybe it is the will of God […] that these people died in the tragedy." (See Figure 4.16).

(iii) Pictures used in task 3 by Coleman to illustrate the MV. Bukoba tragedy.

Figure 15 – sinking ship.

Figure 16 – person crying with agony.

Judging from the three task documents completed by Coleman showed that he had a high visual-spatial intelligence. This finding was supported by the results of the multiple intelligences survey questionnaire in which Coleman received a score of 8/10. Coleman's school progress reports also showed that his average score was 81% (distinction level) for biology, geography and computer studies. Learners who have imaginative skills, visualization ability and who are able to use pictorial images creatively will find that their performance in these subjects can be significantly enhanced by these abilities. Coleman's scores and results in such subjects suggest that he likes to think in images and pictures, draw, and use graphs, maps and diagrams. In an interview that I conducted with Coleman's mother, she supported the suggestion that he might have a strong visual-spatial intelligence. She said:

> Coleman is a person who likes to imagine and visualize things […] He has always dreamt of being a pilot [from when] he was young at the age of five until today [...] He always said he would like to visualize the world from the sky.

By actively employing his visual-spatial skills in all of his tasks and showing a distinct preference for using pictures and images in all three tasks, Coleman showed that he scores highly in this kind of intelligence

#### 4.6.1.3 Verbal linguistic intelligence

Verbal-linguistic intelligence is expressed through the medium of language. People who are strong in this kind of intelligence have the capacity to communicate well and make sense of the world through language (Krechevsky & Seidel, 1998). Coleman's writing skills were good. In task 1, for example, he used simple but cogent sentences to describe his ideas, and he arranged his work in coherent themes. He led into his task with an introduction and he used subtitles (such as Transmission, Symptoms, Disaster implications, and Prevention) to good effect. The information he supplied was straightforward and to the point, as may be seen in Figure 17 below.

**TYPHOID FEVER**

Typhoid fever is one of the dangerous diseases affecting our society. Typhoid fever is contracted when people eat food or drink water that has been infected with Salmonella typhi.

*TRANSMISSION.*

Typhoid fever is transmitted by food and water contaminated by the faeces and urine. Polluted water is the most common source of typhoid fever. In addition , shellfish taken from sewage contaminated beds, vegetables fertilized by night soil and eaten raw, contaminated milk and milk products e.g. butter, yoghurt, and ice cream have been shown as source of infection.

*SYMPTOMS.*

It is recognized by the sudden onset of sustained fever, sever headache, nausea and sever loss of appetite. It is sometimes accompanied by hoarse cough and constipation or diarrhoea. Paratyphoid fever shows similar symptoms but tends to be milder and the case fatality rate is much lower. The annual occurrence of typhoid fever is estimated at 17 million cases, with approximately 600,000 deaths annually world wide. Typhoid fever is a global health problem affecting an estimated 12.5 million people annually and is endemic in many countries, particularly those in Asia, **Africa,** and South America.

*DISASTER IMPLICATIONS.*

With disruption of the usual water supply and sewage disposal and if there is no control of food and water transmission, typhoid fever may occur if there are active cases or carriers. Efforts to restore safe drinking water supplies and sanitary disposal facilities are essential. Selective immunization of special groups such as school children, prisoners and municipal or hospital personnel is important.

*PREVENTION*

- To protect and chlorinate public water supplies. Provide safe water supplies and avoid possible back flow connections between sewers and water supplies.
- Disposal of human faeces in a sanitary manner and maintain fly proof latrines.
- Use scrupulous cleanliness in food preparation and handling.
- Educate people regarding washing their hands before eating.

**Figure 4.17:** Coleman's written transcript on Typhoid fever.

Coleman purposefully used simple language and subheadings to convey his information because he wanted to use the task as the basis for a television programme for his educational strategy to educate his community about typhoid fever. (Some people in his community would not have understood more complex language because they had very little formal education.) During the presentation session, Coleman said:

> My reasons for choosing a TV programme for this disease are: I want to reach more people all over the country […] I used simple language as people have to listen and understand what they are required to do to stop the disease. They need to understand the importance of keeping the environment clean. Simple language is important […] Hence, they will be able to get a lot of information about this dangerous disease. (Presentation made by Coleman on 8 January 2004).

During the discussion and feedback session, other learners said they did not think that a television programme would be effective because, firstly, many people do not have television sets in their houses, and, secondly, most rural areas (i.e. the areas in which people are most likely to be affected) did not have electricity and so people there would not have been able to use television sets even if they could afford them. During this discussion, Coleman continued to defend his choice of using television as an educative medium by saying:

> A TV programme is still effective because, apart from the presenter narrating the important information about typhoid fever (as it could have been if a radio is used), pictures can also be used to show how typhoid fever is transmitted, how people are hospitalized in hospitals and preventive measures can be taken, and everything will be seen on TV. On TV they can also show the text which people can also read. Then, the few who will be able to see this programme will tell others who do not have TV at home (Presentation made by Coleman on 8 January 2004).

Although Coleman knew that the television programme format he preferred would not reach all the people in his community, he nevertheless adduced some good reasons why it might still work to a limited extent.

For task 2 (the assignment about landfills and their effects on the environment), Coleman prepared his information component in an MS Word document. He organized and sequenced his information well. He presented it in the following order: (1) What a landfill is, (2) How a landfill is formed, and (3) How a landfill can become a serious health hazard in the environment. The following excerpt is taken from that part of the text in which he explains how landfills can become health hazards:

> Because of the location of the landfill near places where people live, it causes lot of loose garbage in and around houses. Local residents experience dust in the dry season, mud in the wet season and a lot of smell, smoke and chemical fumes from the landfill. Sometimes there are fires at the landfill, which could be started by local residents who are unhappy at the way the landfill operates or they are trying to reduce garbage by burning it. These fires cause a lot of smoke problems for locals, and also disrupt the operations of the landfill. Moreover, landfills can cause diseases for example Cholera and can be transmitted to people through the vector called housefly (Excerpt from text saved by Coleman on 10 January 2004).

For task 3, Coleman wrote a story about the MV Bukoba tragedy in Tanzania. He started his story by narrating how different countries have been affected by tragedies, and how these countries have lost people and material wealth. Coleman wanted to explain how important it was for people to ***understand*** that tragedies do occur, and that they affect many people – and not only the Tanzanians who were tragically and personally affected by the sinking of the MV Bukoba. Here is an excerpt from the text of Coleman's presentation:

> Many countries all over the world have been suffering because of the tragedies of sinking of ships. Because of that, many countries have lost their people and many families have lost their loved ones. Few examples of countries who have suffered from this type of tragedy are the Philippines when they had to experience the sinking of the 13,935-ton MV Princess of the Orient near Manila. Guinea Bissau also suffered in 1998. About 200 people were drowned as they fled fighting in the West African state (Excerpt from text saved by Coleman on 16 January 2004).

Coleman used international examples too, to give the general information, and then in the local context, he specifically narrated his story about MV Bukoba tragedy that occurred in Tanzania in 1996, killing approximately 1,000 people. He organized the information from general to specific. A section of the text explaining MV Bukoba tragedy is as follows:

> Now we are going to look at the biggest shipping tragedy in Tanzania, which took place on May 21st 1996, when the steamer MV Bukoba sank on Lake Victoria 30Kms from Mwanza port. The steamer had a capacity to carry 430 passengers but MV Bukoba carried more than 1,000 people, because it was feared that as many as 1,000 have died. Among the dead there were some 400 children returning home from school after their final examinations (Excerpt from text saved by Coleman on 16 January 2004).

Coleman also revealed his own spirituality and sensitivity to spiritual values in the following words:

> The pain of this tragedy will continue to be in the people's hearts and they will never forget the date of May 21st 1996. The people of Tanzania continue mourning for the loss of their loved ones, especially the families that lost more than five people. Other people have also described the tragedy, which is mainly blamed on the inefficiency on the part of Tanzania Railways Corporation (TRC), but it can be that it is the will of GOD (Excerpt from text saved by Coleman on 16 January 2004).

In general, Coleman's text documents showed that he could use language to produce different effects – to motivate, to encourage, to convey information, and to show emotion. The vocabulary that he used was simple and appropriate for his purposes and the possible limitations of his audience (theoretically, the community). In his PowerPoint slides, he included pictures and text that were well sequenced. These achievements confirm his verbal-linguistic intelligence score. The multiple intelligences survey questionnaire indicated that he has a verbal-linguistic score of 9/10. This means (partly) that he enjoys explaining his ideas to others. His school progress report showed an average score of 80% in English, Kiswahili and French. He performed consistently well in all his language subjects.

#### 4.6.1.4 Interpersonal intelligence

Coleman's performance ability in interpersonal intelligence was relatively low compared to his other intelligence performance abilities. His score of 6/10 was taken from the multiple intelligences survey questionnaire. Interpersonal intelligence is expressed when learners undertake actions that involve organizing, relating to, manipulating, and

mediating for other people. People who score highly in this intelligence are people who like to help others, who have many friends, and who enjoy assigning roles to others (Nitko, 2001). These factors were accounted for in this study because most learners were required to work in pairs.

During this study, Coleman was allowed to work alone because his friend, who he was supposed to work with, had to attend a funeral of a relative, so he left before the research began. Because he was working alone, some of Coleman's behavioural performances (in instances in which he might have spoken to others, helped them verbally or discussed ideas with them) were absent because of his working alone and so could not be accurately be detected or assessed during the observations. Even so, no other learners asked him for any assistance. He also did not consult any of his colleagues (the other learners) on any issue before the discussion. During the discussion and presentation sessions, he asked questions where possible. The questions that he asked were well structured and they brought a liveliness to the class discussions because he wanted to present correct information (and that only), and was ready to justify his suggestions when need be. When Coleman was not presenting, he would sit in an alert posture and listen attentively to others. He is rated as low person when it comes to interpersonal skills.

To return for a moment to Coleman's dream of becoming a pilot one day, the overall assessment shows that Coleman performed well across several intelligences in each task. His last comment in one of the interviews was this:

> To make sure that I can become a pilot in future, I am working hard on all my science subjects, for example physics, chemistry, biology and mathematics. These are my favourite subjects. […] Also I am now doing computer studies in order to familiarize myself with the knowledge of computers and what is taking place in the rest of the world.

Coleman's strong performance abilities on the basis of three different intelligences lend credence to the hypothesis that learning can be better accounted for across a wide range of skills and understandings. In all the three tasks, for example, Coleman's performance abilities ranged from high logical-mathematical ability, verbal-linguistic and visual-

spatial to a low interpersonal intelligence. Krechevsky (1998) tends to confirm this hypothesis when she says that information-processing capacities and problem solving features of each intelligence are to a large extent independent of one another. She notes however that the intelligences do not work in isolation (Krechevsky 1998, p. 4).

### *4.6.2 Story 2: A learner strong in verbal linguistic intelligence*

#### 4.6.2.1 Verbal linguistic

Rachael was a learner who demonstrated a strong ability in verbal-linguistic intelligence. At the time of the study, she was 13 years old and the youngest in her class. During the pre-session discussion before the study, Rachael said she liked reading, writing and discussing issues. This information was supported by the results of her multiple intelligence survey questionnaire which showed that Rachael scored 8/10 in verbal-linguistic intelligence.

Rachael's performance abilities in the open-ended digital learning tasks also confirmed that she has an ability to express herself through the use of language. In addition, she communicated well and was able to translate what she was thinking into sensible speech (Krechevsky & Seidel, 1998). The results of the three tasks she performed showed that she scored three points (the maximum). This means that her performance abilities were above average. For task 1, the cholera assignment, Rachael started out by summarizing her work in Word document. In this document, she presented the necessary information in short sentences that were clear, vivid, and to the point. She then used this information to construct a radio programme, which was the format that she selected as the main vehicle of her educational strategy to educate her community.

Rachael also arranged her information in coherent themes. She began each subsection with a title and then further divided the text by means of subtitles. In this way, she produced an introduction, and then dealt with the symptoms of the disease, its means of transmission, the effects of the disease, methods of cure, and finally, preventive measures. In order to clarify some of the points in her informational presentation, she gave examples of regions that were more affected by cholera, and explained why, in

some regions, there was a higher incidence rate of cholera than there was in others places such as the Dar es Salaam Region. The following is part of the text that Rachael used to explain how cholera affects these areas. It illustrates the vivid but forceful way in which she used language:

> Places with a large population of people are mostly affected with Cholera. For example, [in] Manzese, Kigogo, Vingunguti they never follow health rules. They throw garbage wherever they want. Dirty water from bathroom and toilet sewage are not properly disposed, and is allowed to flow out in the open, bringing a lot of flies. These flies later sit on the food. Children are the ones mostly affected. They never choose a safe place to play. They sometimes play in places where there is dirty water flowing from toilets carrying cholera microbes. Moreover, they rarely wash their hands after leaving the lavatory. At the same time they usually eat with their dirty hands. Then, the most effected places are the places with problem of water supply because they buy water from young boys who use to sell water in gallons, but they do not care about where exactly the water has been collected and what the source of this water is. Also they do not boil drinking water. These people are mostly affected because they drink unboiled water (Text saved by Rachael on 7 January 2004).

During the presentation session, Rachael was required to attempt to persuade others that her chosen format of a radio programme would be the best educational strategy for educating her community about the disease. The main reason she adduced in defence of her choice of her primary strategic vehicle was that the radio was the most effective and widespread means of getting information to the kind of people who lived in her community. She also noted that most people in her community (although poor) *could* afford to buy a radio, even if it is a hand radio. She explained that radios were prized possessions even though her community was not served by electricity. The people in the community bought and used batteries as a source of power for their radios. She further explained that although few people could afford to buy a television set, ownership of radios, especially portable radios, was fairly widespread in her community.

She told her audience that a further advantage of radios for rural people was that they could be taken anywhere, especially the portable ones. Thus, even when workers went to work on farms, they could take their radios with them and thus stay in touch with what

was happening in the country, the nation and the world. Radios were thus a primary source of political and other vital information such as disease prevention measures for the community. Rachael also noted that it was necessary for her to choose a radio programme rather than a flyer for her community because while not everyone in her rural community knew how to read and write, everybody could listen to a radio and think about what they were hearing. By presenting all these points in a cogent and reasoned manner, Rachael used her strong language (verbal-linguistic) ability to present and gain support for her decision to use a radio programme as her primary strategic means.

In task 2 (Landfills and its effects on the environment), Rachael chose to write a letter to the chairman (the leader of her community) in MS Word format. The information that she conveyed to the leader was presented under the following heads: (1) What is a landfill? (2) How a landfill is formed (3) How a landfill can become a health hazard to the people living in the community. Rachael also included information about how the environment could be affected if landfills were not considered to be an environmental hazard. The following extract is a section from Rachael's text (her letter) in which she explains how landfills can affect the environment:

**Environmental problems caused by landfill**

Landfills destroy the good appearance of the environment. It makes the environment look filthy because most of damps do not have gates or fences. During windy and rainy season the garbage is spread in other areas and start giving very bad smell. If not well-managed, it can cause serious air pollution. Then some of the garbage can create toxic liquid called leachate, which pollutes the environment.

This can be prevented by:

- Buying materials kept in less packaging to reduce by half the rubbish in landfills.
- Grow our own fruits and vegetables than buying canned or packed food.
- Compost manure can be made from food scraps
- Refuse taking plastic carrier bags from shops. Take your own fabric bag instead.

Major problems when a landfill is established are:

- It takes a long time for waste to break down (decompose)
- It destroys the aesthetic of the environment
- It pollutes air, soil and water.
- It brings a lot of health hazards to children and adults.

*(Text saved on 10th January, 2004).*

**Figure 4.18:** A text prepared by Rachael to explain how landfills can be an environmental hazard to a community.

Rachael managed to assemble the correct information that she needed to convey to the village leader and to the other members of the community. Her letter included selected information that it was important for the village leader to understand. The essential information that the letter conveyed included the following: what is a landfill is; the amount of garbage produced per day in the city; possible health hazards arising out of improperly managed landfills; specific suggestions to the village leader about what could be done to reduce the amount of garbage being produced by the people, and how a landfill could be prevented from destroying the community. Rachael summarized these ideas well and presented them in a way that would enable the village leader to understand how landfills could be an environmental issue and a health hazard for his community.

Here is a short excerpt from Rachael's letter, in which she explains the amount of garbage produced is as follows:

> A landfill is a place where wastes from different places are put. Dar es Salaam has a population of 3.5 million people and these people produce around 2000 tonnes of waste per day. About 20% gets collected. Up to 80% consists of organic food scraps that cause a bad smell very quickly in warm temperature and finally can cause diseases.

The following part of Rachael's text explains possible health hazards that can be caused by improperly managed landfills:

> Major health hazards caused by a landfill: Communicable diseases can be caused during rainy season, for example, Cholera and Typhoid fever. Problems in respiration result from smoke which is in the air when burning the wastes. Cancer of the lungs can also be caused by smoke while other potential diseases include cough and influenza.

During the presentation session, Rachael said that the information she had included in the letter to the village chairman was important because village leaders in Tanzania are the decision makers on all issues that pertain to cleaning, conservation of the environment and water sources in their areas. She therefore felt that it was important for her to explain to the village leader what an adverse impact on the environment a landfill might have.

For task 3, Rachael wrote a story about MV Bukoba tragedy in Tanzania. She started her story with this striking sentence that led straight into the story: "On this specific day, 21st May 1996, the steamer MV BUKOBA sank on Lake Victoria 30 kilometres from Mwanza Port..." This was an excellent and dramatic way of introducing such a story, and it suggests that Rachael might one day become a distinguished journalist (a career option for which her strong verbal-linguistic ability would make her well suited). Rachael then wrote the remainder of her story in a coherent and cogent manner and included information about how many people from a neighbouring country, Uganda, had died on

MV Bukoba. The part of the text that gives the information about the people from Uganda who died is as follows:

> More than 10 Ugandans are believed to have died in the accident when the Tanzanian vessel MV Bukoba capsized. The MV Bukoba left the port of Bukoba with three hundred passengers. But on its way to Kemondo Bay to pick more cargo, more passengers forced their way in. The ship did not have a passenger [section] for third class passengers and so it was overloaded. An announcement was made through radio in Uganda and identified the clergy (who died in MV Bukoba) as Brothers Mpuga and Alexandria from Barakaloli brothers of Kiteredde in Masaka Dioceses in Western Uganda (Text saved by Rachael on 16 January 2004).

In general the text documents prepared by Rachael were well arranged into paragraphs that made a clear and logical presentation of information. She also included examples, where possible, to enrich and amplify the information. The vocabulary that Rachael used was simple but forceful, and was well understood by her peers during the presentation session. Her strong verbal-linguistic intelligence was supported by her school progress report in which she had scored an average of 71% in all three language subjects: English, Kiswahili and French. A learner requires definite linguistic skills to perform well in these subjects.

Rachael's good writing and communication skills during the presentation sessions were also confirmed by her mother in information gathered in the interview with the parents. Rachael's mother told me that she had also noticed Rachael's strong verbal intelligence and abilities. Rachael's mother described her daughter as a person who was good in languages and who enjoyed reading books. She also added that Rachael was fluent in the speaking and writing four different languages. She said:

> My daughter is mostly quiet, and her best hobby is reading books. She likes staying indoors and especially in her bedroom, and in there she will be reading. She likes reading storybooks, academic books and novels. She is a very good reader like me. Whenever I go to a bookshop I will always buy a book for her and myself. Moreover, when you tell Rachael to tell you what she read in the book, she can do it by narrating the story to you or [she can]

> summarize the story on a piece of paper. (From an interview conducted with Rachael's mother on 18 January 2004)

Rachael's mother added the interesting information that her daughter was good in an important language other than English, Kiswahili and French. She said:

> My daughter is good in languages and she can speak and write four different languages fluently. These are Kiswahili, English, French and Arabic. She uses Arabic in her religion classes because Arabic is not used in schools. Being a Moslem she needs to know how to read and write in Arabic. (From an interview conducted with Rachael's mother on 18 January 2004).

When I compared Rachael's performance abilities across the four intelligences in all the three tasks, I saw that although Rachael was strong in verbal-linguistic intelligence, she was comparatively weak in visual-spatial, logical-mathematical and interpersonal intelligences. I shall now describe this more fully in the following sections.

### *4.6.2.2 Visual spatial*

The main sign or evidence of visual-spatial ability is a preference for using pictorial representation in the form of drawings, pictures, clip arts, or for using colours in text documents. Rachael, however, did not (with one near exception noted below) use any pictorial or graphic representations in the three task documents or in the presentation of her slides. She also did not draw anything on the manila sheets that were provided for their use during task completion and presentation.

However, she did use a ***table*** in her handling of task 3 to indicate the number of people who had died, the number of survivors, and the number of people who had been trapped alive in the hull of the MV Bukoba (see Table 4.7 in the section 4.6.2.3 Logical-mathematical below).

In the assessment of her visual spatial intelligence, Rachael scored 2 points. This meant that her performance ability was average. These findings were supported by the results of the multiple intelligences survey questionnaire, in which she scored 2/10. During the

interview sessions, Rachael said that her performance ability was below average in visual-spatial intelligence because she was not good at drawing. Her school progress report showed that Rachael received an average score of 66% in biology, geography and computer studies. Although Rachael might not have been good in drawing, she might conceivably have improved her performance abilities if she had been given the opportunity.

#### 4.6.2.3 Logic mathematical

In logical-mathematical intelligence, Rachael was an average performer. Rachael clearly preferred not to use numbers or any kinds of graph in any of her tasks. She did not use any numbers in task 1 even though her text logically sequenced chains or series of events. She introduced her work by mentioning what caused cholera, how the microbe was spread, and symptoms of the disease, methods of treatment and prevention, and the names of places in which the incidence of cholera is high. She identified all these elements in her Microsoft Word document and in her slide presentation. For task 2 (Landfills and their effects on the environment), Rachael used numbers in her first paragraph when she referred to the number of people living in Dar es Salaam, the amount of garbage that was produced by these inhabitants every day, and the percentage of this garbage that was collected every day. This part of her text is contained in the section that deals with the amount of garbage produced in task 2. Her text was logically sequenced throughout.

In task 3, Rachael used subheadings to ensure the narrative sequence of her text and to make of it a coherent story about the MV Bukoba tragedy. Rachael explained when and where the tragedy occurred, the number of people who were in the ship at the time, the capacity of the ship, and how the capsizing of the vessel occurred. She followed this by noting the number of people who had died, the number who were rescued, and the number of dead bodies that were ultimately removed from the ship. She also included interesting information about the countries which had also lost people in the tragedy. Although Rachael's use of paragraphs was excellent, she supplemented this by inserting a

table that summarized the number information pertinent to those who had died in and who had survived the MV Bukoba tragedy. Rachael's table is shown in Table 4.7 below.

**Table 4.7:** A table prepared by Rachael to show by means of numbers the categories of people who had died in or survived the MV Bukoba tragedy

| SURVIVED | DIED | | | |
|---|---|---|---|---|
| SURVIVORS | Trapped alive, died later | Bodies recovered from water | Tanzanians | Ugandans |
| 125 | 522 | 158 | 1000+ | 10 |

It is interesting to note that Rachael's performance is high when it comes to logical-mathematical intelligence in classroom activities. The results of the school progress report showed that Rachael scored an average score of 70% in the three subjects, physics, chemistry and mathematics. This means that although her performance abilities were above average in classroom activities, her performance preference in the open-ended digital learning tasks was rated as weak. These findings are supported by the results of the multiple intelligences survey questionnaire which indicated a score of 6/10. This means that Rachael was an average performer in this area.

### 4.6.2.4 Interpersonal intelligence

As far as interpersonal intelligence goes, Rachael was a relatively quiet and unassertive person although she worked well with her team mate and took the lead by assigning activities to her team mate to complete. On occasions, Rachael became frustrated with her team mate who, she felt, was not pulling her weight in the completion of the tasks. During the focus group interviews, Rachael said: "I worked well to complete the tasks, but sometimes my partner did not come and I had to work alone, or sometime she would come in late, and I have do most of the work alone."

This kind of behaviour on the part of Rachael's team mate indicates that, in collaborative work, some learners are not committed to do what they are supposed to do. This can become a major source of frustration to others who are committed and diligent.

Rachael's mother's evidence supported a better rating of Rachael's interpersonal ability. In one of the interviews with Rachael's mother, she said that though Rachael seemed to be quiet, she had many friends. This indication of interpersonal ability doubtless helped Rachael to work harmoniously with her team mate in spite of the latter's less than satisfactory behaviour. Rachael willingly worked her way through all the three tasks and even managed to inspire her team mate's support and participation towards the end when they were required to make their presentations. Before the presentations, Rachael explained to her team mate what she had done and what would be expected from them. So both of them would present their texts and participate in the discussions.

### *4.6.3 Story 3: Strong in interpersonal intelligence*

#### 4.6.3.1 Interpersonal intelligence

The third story is about Abigail. Abigail was a form three learner and 13 years old at the time of the research. Abigail performance abilities in interpersonal intelligence were uniquely strong. Her other intelligences were weak when compared to her interpersonal abilities. During the debriefing session before the study started, she said: "I like working with friends and I also like team work. I have many friends too. I like to socialize with my friends here at school or at home." According to the data shown in Table 4.1, Abigail had a high intelligence profile in interpersonal intelligence. In the multiple intelligences survey test instrument (a self-reporting questionnaire), Abigail scored 10/10 in all the items indicated in the questionnaire.

In one of the interviews she said, "I have organized a study group at home in which I am the leader, and many of my friends like to work with me." Abigail possessed an unusual ability to organize people and work with friends.

In an interview session that supported these findings, Abigail's mother said:

> My daughter is very talkative and talks to everybody. She has made a lot of friends because of that. She is very active and works well with others. But she is not good in physical games (Excerpt from an interview conducted on 28 January 2004).

Abigail's impressive ability in interpersonal intelligence is supported by the results of the observation checklist in which she scored 3 points (indicating a high profile) in interpersonal ability. Abigail worked well with her team mate (although she naturally assumed the leadership role). She was always talking and giving instructions about what should be done as it can be observed in the following pictures, taken from the video recording.


**Figure 4.19:** Abigail in discussion with her team-mate**.**


**Figure 4.20**: Abigail elaborating a point.

Apart from this, Abigail was constantly engaged in helping other learners from other teams. A good example of this occurred when Abigail and the others were completing task 1. Abigail was consulted by a member of another team who solicited her help on behalf of their team. They needed Abigail's help to understand PowerPoint because it was not altogether clear to them.


**Figure 4.21:** Abigail helping one of her friends.

Abigail immediately offered her help. She went over and showed them how to use the PowerPoint program. Abigail's friends trusted her and always asked for her help. She had built up this trust over time because she was always ready to offer a helping hand where it was needed. Although I as the researcher in this study was present at all times in the classes and available to give assistance in computer skills or in any other legitimate matter to the learners, they obviously felt more comfortable in asking Abigail for help. In one of the discussions (focus group interviews), I asked one of the learners why they had asked Abigail more for help than they asked the other learners. She replied:

> Abigail is always ready to offer a helping hand and I am comfortable asking her for help. Abigail is always of help all along even in our daily classroom activities. I don't like asking help from other girls because if they know something, they will tell you to wait first, and sometimes they will not help you that much. But Abigail will not keep you waiting.

The discussion in this section involved Anna, Abigail's team mate, with whom she worked together in all the three open-ended digital learning tasks and presentations. It was important to include Anna (for reasons mentioned below) because the interpersonal abilities of Abigail were more obvious as she worked with her and the other members of her class. Observations of Abigail working on her open-ended digital learning tasks showed that she was always talking and discussing matters with her peers. This was in contrast to Anna who was a bit shy and ill at ease and who now and then offered a few comments. It was always Abigail who initiated discussion in their team and who kept the

work going. Working in groups in this way provided Abigail with opportunities to demonstrate in natural learning conditions how strong her interpersonal abilities were. The setting allowed Abigail to talk to her team mate and to share her skills with members of her own and other groups.

Here is an excerpt from a discussion between Abigail and Anna as they worked on their open-ended digital learning tasks:

> Anna: W*hat are we going to do now?*
> Abigail: *Mmm. I think we need to read the resources first and summarize the work on a piece of paper.*
> Anna: *Then?*
> Abigail: *I will type as you read from the paper… Is that okay?*
> Anna: Yes.

Abigail also controlled most of the activities in which she was involved by opting for natural leadership role in any situation. Thus, for example, Abigail rather than Anna typed the tasks. Abigail made it Anna's responsibility to read the information while she typed it. When a division of work was decided in any team, Abigail always assumed the leadership role. *Working cooperatively together* seemed always to be Abigail's preferred way of doing things. It was remarkable to note that Abigail's interpersonal skills were evident not only in her work on the open-ended digital tasks, but also in her cooperation with other members of her community as they accomplished various tasks together.

Abigail's interpersonal ability, as I have noted above, extended beyond classroom creativity and organisation. She thinks that many things can be done collaboratively and by sharing. Abigail says that she learns more from working with other people and from sharing skills, information and ideas:

> I like working with other people because by working in a team we share ideas, we are able to correct each other when someone makes a mistake.

Abigail's ability to work in teams and her actions as a facilitator and a leader are demonstrative of strong interpersonal performance abilities. Her interpersonal

intelligence can be seen to be unusually strong when one compares it to that of the other learners who participated in the same study.

### 4.6.3.2 Verbal linguistic

In verbal-linguistic ability, Abigail was a medium-range performer. Her task documents showed that Abigail's linguistic ability was medium. Although her ideas were well connected and issued in a coherent text, the results of her school progress report showed that she attained the average score of 56% (which rates as medium) in all her three-language subjects: English, French and Kiswahili.

During the presentation session, Abigail was very active. Abigail's verbal abilities were more pronounced then written linguistic skills. This was in contrast to Anna who was a bit shy and ill at ease and who now and then offered a few comments. They both liked to ask questions and they contributed actively to the discussions. But, Abigail was always the first to initiate the discussions during the presentation sessions. She asked questions in order to obtain clarification from others, especially when she felt that the arguments they were offering were not clear or persuasive enough to support the educational strategies that they had selected as their primary means of community education.


**Figure 4.22:** Abigail asking for clarification.

When it was Abigail and Anna's turn to present, their fellow learners also asked *them* a lot of questions. They insisted on getting clarification about why they had chosen a radio

programme for their educational strategy for their communities in tasks 1 and 2. Their colleagues wanted them to justify why they thought that a radio programme would be effective as their primary educational strategy when they knew that not everybody had a radio at home. Abigail and Anna gave the following reasons to support their selection of the radio programme format:

> First, a good number of people have radios compared to TV, because radios are cheap, for example those small portable radios. Even in the villages where there is no electricity, people have radios, because they use batteries. Second, many people listen to radios for news and other information so the information will reach them where they are. Third, some of the people are illiterate (cannot read and write) but they can listen to radios and understand the information about cholera and landfills compared to if they are given flyers to read. (Presentation by Abigail and Anna to the group on 23 January 2004)

As the discussion progressed, other learners wanted to know what would happen to people who did not have radios because it is true that not everyone in the village has a radio. Abigail was the first to answer and the following discussion ensued:

> Abigail: *It is the best means of reaching these people as many of them do not have TV.*
> Karen: *Do you know that, in most communities, not everyone has a radio?*
> Abigail: *I know most have radios even if it is a small one.* […] *Moreover, people in the village also share their things. On an important thing like this* [cholera], *they would even go to their friends place and listen.*
> Karen: *But all of them cannot fit in the house?*
> Abigail: *Yah… They will sit outside; people do that most of the time.* […] *They will listen from this radio as they are seated outside. Hence, radio is still an important strategy to use in educating people.*
> (Abigail in conversation in a presentation by Abigail and Anna to the group on 23 January 2004).

The picture below shows Abigail and Anna in conversation with their peers. They both possessed a capacity to express themselves and to get others to understand why they had done something (in this case, why they had prepared their tasks in the way in which they had done).


**Figure 4.23:** A question addressed to Abigail from a a colleague, during the discussion session.


**Figure 4.24:** Abigail elaborating a point.

### 4.6.3.3 Visual spatial intelligence

Abigail's preference for the use of visual representation in the three tasks was average. Abigail scored 2 points (which means that she used pictorial representation minimally), and she showed a minimal use of colour. She showed some use of artistic sense and colours in her writing of the headings that she used in tasks 1 and 2. Below is an example of the word art that Abigail used in task 2.


**Figure 4.25:** The use of Word art by Abigail in task 2.

When discussing about cholera as she presented slides relating to task, Abigail showed a picture of a pot with boiling water. Abigail then noted the importance of safe and clean water as one among many other measures to reduce the spread of cholera. "People have to be educated on how to have safe water. They need to boil their drinking water before they use is as drinking water."

**Figure 4.26:** Boiling water to prevent cholera.

These findings are supported by the results of her school progress report in which Abigail attained an average grade of 59% (medium) in three subjects, and the score from her multiple intelligences survey questionnaire (she scored 5/10 for visual-spatial intelligence).

#### 4.6.3.4 Logic mathematical

Abigail's performance in logical-mathematical ability is medium. Her school progress report showed that she had an average score of 55% (medium) in the three subjects that is physics, chemistry and mathematics. This means that her ability to perform calculations and use numbers is average. These results were supported by the multiple intelligences survey questionnaire in which Abigail scored 6/10 (medium). Abigail's overall performance in her open-ended digital learning tasks was also average. She did not, for example, use any number-related format in task 1 even though the learners were all required to mention the number of people who had been infected with and had died from cholera. The learners in this research were also required to mention the economic implications (in monetary terms) of the disease to the country. Abigail did not incorporate any of this numerical data into her answers. In task 2 (the assignment about the landfills and their effect on the environment) she was likewise expected to mention the amount of garbage produced every day in Dar es Salaam and she was also expected to say how the landfills can affect the health of people living near to them. This she did not do. In task three (the MV Bukoba tragedy), Abigail similarly did not offer any numerical information either in her task or in the presentation of her slides. Nowhere in Abigail's work were there any graphs or tables – either in her text or in her presentation documents.

But Abigail logically sequenced her text documents by using subtopic headings. A section of text from her task 2 document demonstrates this. It is shown below:

PROBLEMS.
Urban waste is a fast growing problem driven by rapid urban population growth, which is general at least twice the respective national population growth rates.

EVIDENCES.
Due to this problem there are evidences to prove for example:
-Increasing illegal dumpsites
-Irregular collection of garbage.
-Rising garbage piles and dumps in city alleys, streets and residential areas. Some of the waste overflows and makes rivulets in different direction, destroying the environment even beyond the area.

**Figure 4.27:** A section of the text as sequenced by Abigail.

## *4.6.4 Story 4: Strong in visual spatial intelligence*

### 4.6.4.1 Visual spatial

This is the story about Kim who was 16 years and in form three. Although he exhibited competence in visual-spatial intelligence, his performance abilities were low in logical-mathematical, verbal-linguistic and interpersonal intelligences. In the following sections I will discuss how Kim performed in all the three open-ended digital learning tasks.

Visual-spatial intelligence is the capacity to imagine, construct, manipulate and make sense of images and pictures. Learners can exteriorize their visual imagination and concepts by using charts, diagrams and clip art pictures, and also by making use of colours. In this study, Kim showed a remarkable use of visual abilities in his tasks. He received a score of 9/10 from his multiple intelligences survey test instrument. He also self-reported that he could use images and pictures creatively and that he could recall things in mental (visual) images from charts and diagrams. His school progress report also indicated that Kim was high in visual-spatial ability because he scored an average of 75% in the three subjects that is biology, geography and computer studies.

Kim's performance abilities in all the three tasks were quite exceptional. He first made selective use of pictures and images throughout his task documents and presentation slides, and drew a poster on a manila sheet as part of his educational strategy.

For task 1 (Health and diseases), Kim selected typhoid fever as his topic. In his text document Kim included pictures of the microbes that cause typhoid fever. He used this picture to illustrate his speech when explaining the causes and means of transmission of typhoid fever. In order more clearly to explain how to prevent this disease, Kim used a picture of open hands to bring home to his audience just how important it is to wash our hands before we eat or handle any food at all.

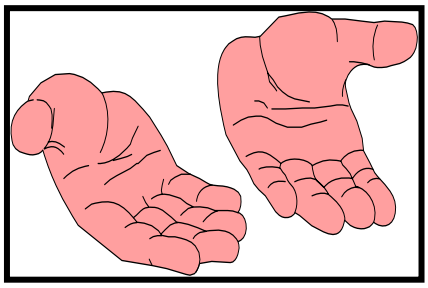


**Figure 4.28:** Hands that need to be washed (used by Kim to illustrate a point in task 1).

During his presentations, Kim used various pictures in his PowerPoint slides. One of these more remarkable pictures (Figure 4.29) depicted a cemetery. In his presentation session, Kim made the following remarks to accompany this picture.

> It is surprising how more and more people are dying each year. The government has to help in educating people about the disease. We are going to use a TV broadcast as our strategy to educate our community.

**Figure 4.29:** Kim's picture showing a cemetery.

When Kim was asked why he had chosen this picture, he said: *People will be scared and maybe it might help them to act immediately. People do not want to die.*

Kim's use of visual images did not end there. He also warned the class during his presentation that the population group most affected by this disease in the community is the children. They also therefore need to be educated about typhoid fever and other water-borne diseases. They are the most vulnerable sector of the population because when some of them go out to play, they forget to take clean and safe water with them. And so they end up drinking dirty and contaminated water (as shown in Figure 4.30).

**Figure 4.30:** Kim's picture showing children drinking dirty and contaminated water

Kim chose Marine Pollution as his topic for task 2 (learners could choose between marine pollution and landfills and their effects on the environment for this task). Kim then proceeded to use Word document to summarize the information that he collected about marine pollution. Kim's work was especially interesting in the visual representation part of his assignment. He first used computer clip art and pictures to show the audience different marine organisms and the way in which they could cause pollution on beaches. He inserted all these pictures into his PowerPoint presentation slides.

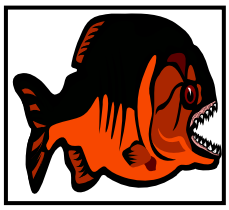


**Figure 31** - Endangered marine organisms.

**Figure 32**– Waste products that destroy the fragile marine ecosystem.

While making his PowerPoint presentation, Kim brought home to his audience the importance of conserving the marine environment and the fact that a failure to do this would result in the death or destruction of all the marine organisms that live in the ecosystem. During his presentation, Kim said:

> Marine organisms are being endangered because of human activities, like the use of dynamite, fishing and [the] throwing [away] of waste products. For example, the beach around Posta is destroyed. We need to educate people about this.

Kim's preference for using pictures and images was also confirmed to his PowerPoint presentation. He also demonstrated that he had a capacity to draw convincingly by using a manila sheet to complete this task. On the manila sheet, he drew a poster for a hypothetical school competition exhibition for which he had to produce a drawing. On this poster Kim drew images to represent some of the major problems that are caused by human activities. They included buildings, industries and bodies of water. He emphasised that some human activities can destroy bodies of bodies of water (such as lakes, rivers and steams) – and even the ocean itself. He demonstrated how effluents from industries and waste disposal all ultimately end up in the ocean because all rivers flow into the sea (see Figure 4.33).

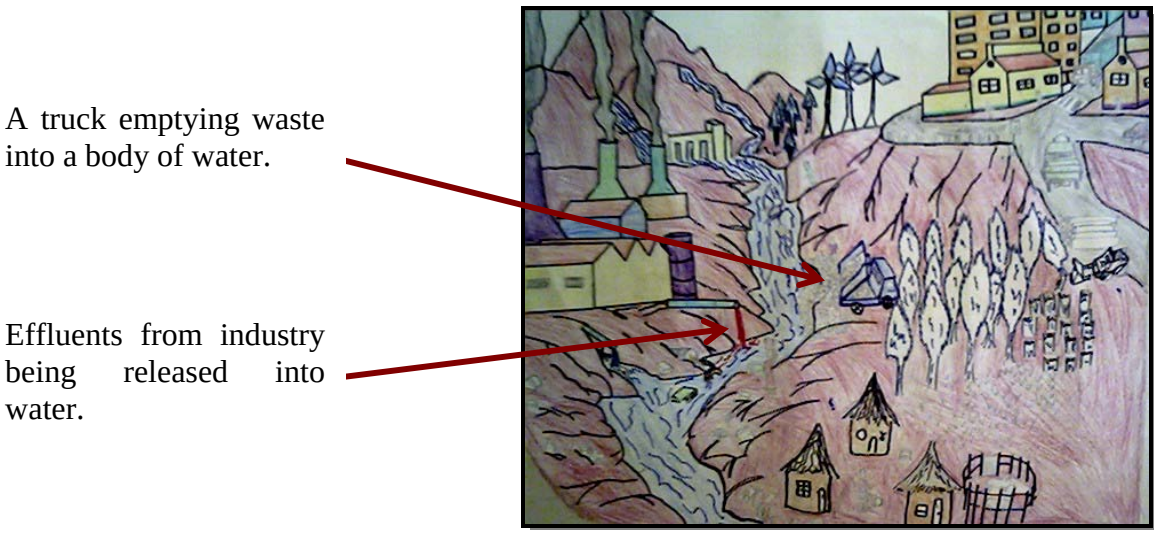
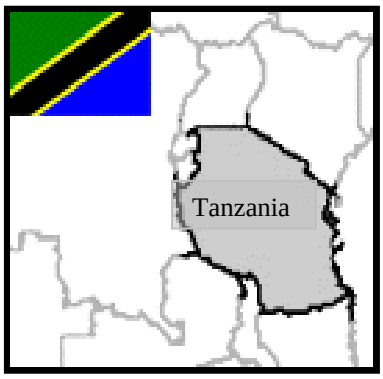



**Figure 4.33:** A poster drawn by Kim on a manila sheet.

In his drawing, Kim demonstrated an imaginative handling of colour. While, for example, he used blue for water, he used red for the effluent produced by industry, yellow and purple for the colour of the buildings, and brown for the soil. His use of red, yellow and purple was both bold and effective. He also spaced the items on the poster thoughtfully

and effectively. Thus the buildings that he portrayed, as well as the river and the other items, were all proportionately distributed on the manila sheet.




In task 3 (the MV Bukoba tragedy), Kim did not use a picture or table in his MS word document. Instead he inserted pictures into his PowerPoint presentation of slides. One of these pictures showed a sinking ship (he took this from his reading resources). Another was of a man who was crying because he had lost his loved ones (these were the same pictures that Coleman had used). Another picture (Figure 4.34) contained a map of Tanzania along with the country's flag. Kim used this to express his love and concern for his country and its suffering people.

**Figure 4.34:** The map and flag that Kim used to express his love for his country and its suffering people.

### 4.6.4.2 Verbal linguistic

His school progress report showed that Kim attained an average score of 68% (medium) for the three subjects English, French and Kiswahili. He also scored 6/10 in the multiple intelligences survey questionnaire – an indication that he had a medium profile in verbal-linguistic intelligence. Kim's performance ability in task 1 was therefore medium; he scored 2 points. He managed to use sentences coherent enough to make a connected and logical text. He mentioned examples of countries that had already been affected with typhoid fever and how the disease had affected the lives of people worldwide. Kim organised his ideas well in his tasks. He mentioned how the disease was caused, its symptoms, methods of prevention, and its worldwide epidemiology. He also spoke about what advice he would give to people who were planning to travel to countries in which typhoid fever was prevalent. Here is an excerpt from Kim's Microsoft Word document in which he deals with some of these points (Figure 4.35).

**Typhoid fever**

As I mentioned in the first time, typhoid fever has killed many people. Now let us know how it has affected and killed people:

-World wide and annually around 17,000,000 cases of typhoid fever have been reported with approximately 600,000 deaths.

-Typhoid fever affects about 400 people in the United States each year and 70% of them get Salmonella typhi when travelling internationally.

-In developing countries e.g. Asia, Africa and Latin America it is said that 12.5 millions people are affected by the disease each year.

**Figure 4.35:** An excerpt from Kim's MS document dealing with typhoid fever

In task 2, Kim explained in his own words how the ocean can be economic important to people living near it. He noted that they could catch and trade in ocean products as a living. They can also gather and sell salt that can then be used in cooking. They could make and sell ornaments and jewellery from coral and also use the ocean as a means of transport. Kim continued to say that the ocean had been destroyed and that more and more marine organisms were being killed as the years passed as a result of human activities such as over-fishing, fishing by using dynamite, the emptying of industrial and sewage waste into inland water bodies of water that eventually all flowed into the sea (see Figure 4.32). Figure 4.36 shows an excerpt from Kim's text in which he explains some of the impacts that human activities make on the ocean.

**The Ocean Pollution**

The ocean occupy about70% on the continent. There are several organisms that live in the ocean such as dolphins, sea cows, seals and so many others. But instead of preserving it human beings destroy the ocean through the following:

(1) OVER FISHING

The people fish out in large quantity and use dynamites to kill fish.

(2) ATMOSPHERIC DEPOSITION

Out of 57 major industries surveyed in the Dar-es- Salaam, 37% of them have been identified as source of air pollution. For example, Tanzania Portland Cement LTD at WAZO HILL account for most of the air pollution.

(3) INDUSTRIES

The waste products from industries are thrown into the ocean. Some of organisms will disappear soon if that problem will not be avoided. These organisms include sea cows, dugongs and so many others who are endangered. (Excerpt from text by Kim saved on 30 January 2004).

**Figure 4.36:** An excerpt from Kim's textual information about ocean pollution

When I examined the story that Kim wrote about MV Bukoba tragedy, I found that the text was (like the others that I have selected for discussion in this chapter) logically sequenced and coherent. It contained an introduction that described how, where and when the tragedy occurred. Kim also included information about how many people died, how many survived, and how many were rescued. He did not, however, give examples of other disasters that have occurred worldwide. During the presentation sessions, Kim presented his part but did not contribute much during the question and answer session. Because he was shy, he allowed his team mate to answer most of the questions that were directed to them. My assessment of his task documents supported these findings about Kim and he was given 2 points. That means that he could be regarded as an average performer so far as verbal-linguistic intelligence was concerned.

### 4.6.4.3 Logic mathematical

Kim's performance abilities in all open-ended digital learning tasks and presentations were 2 points. That means he was an average performer in logic mathematical intelligence. Again, in the presentation of the texts in tasks 1 and 2, one could say it was well sequenced. Kim did use number information to represent his information. In task 3-MV Bukoba tragedy, Kim summarized his story by mentioning when the tragedy occurred, where it occurred and how many people died. Kim also used numbers in the story, and this is as shown in Figure 4.37. However, in all the three tasks, Kim did not use tables or graphs to summarize number information. These findings are supported by the school progress report where Kim had an average score of 58% in physics, chemistry and mathematics. The multiple intelligences survey questionnaire indicated that his intelligence profile was medium with a score of 6/10.

**A SAD DISASTER THAT OCCURRED IN TANZANIA**

On May 21st 1996 'steamer' MV Bukoba sank on Lake Victoria, 30 kilometres from Mwanza. It had a capacity to carry 430 passengers, but as many as 1, 000 are feared to have died, because it was overloaded. 1st class and 2nd class compartments were said to have carried 443 passengers. The 3rd class was cheaper and therefore carried more people; the exact figure was not known. But more than 800 people died while others were rescued with injuries. The bodies that were recovered from the water were badly decomposed. Most of the decomposed bodies were buried in a mass grave (Text saved on January 22nd, 2004).

**Figure 4.37:** Use of number information by Kim.

### 4.6.4.4 Interpersonal intelligence

In general, Kim had low performance ability in interpersonal intelligence. He was shy and kept quiet most of the time, his teammate was the one who kept talking and negotiating activities to be done. However, he participated in the tasks by typing the text that was required, searching for pictures and drawings. During the presentations, Kim presented his part, but during the discussions his team mate answered all the questions that were asked. Kim's ability in interpersonal skills was low and was supported by the

results of the multiple intelligence survey questionnaire, where Kim scored 4/10 (low) for interpersonal intelligence.

From these findings, it is evident that if Kim is given more opportunity to explore a variety of visual arts materials, he could do his best in this intelligence.

### *4.6.5 Conclusion*

The theory of multiple intelligences by Howard Gardner (1983), have provided a theoretical foundation in recognizing the different performance abilities and talents of the learners. The theory acknowledges that learners do possess more than verbal or mathematical intelligence and may have potential abilities in spatial, music or interpersonal intelligences. The main question of this study is how do learners with different intelligences tackle open-ended digital learning tasks?

Alternative assessment or performance assessment was used as an alternative approach in assessing learners' performance abilities or intelligences, from the traditional paper and pencil tests. The aim of using alternative assessment approach was to identify learners' different performance abilities that they would use in solving open-ended digital learning tasks provided for them, and how they would manage to fashion out products that were valued in this study. It was apparent that a wider range of abilities were presented in the learners' task documents and presentations that provided important indicators of the learners' potentials in their strong and weak intelligences as indicated in the theory of multiple intelligences. In the following sections, the summary of the evaluation that was done on the four selected intelligences: verbal linguistic, logic mathematical, visual spatial and interpersonal intelligences and the different ways these learners solved the problems are presented. Included in the discussion is the intelligence profile of the learners.

The identification of performance abilities of the learners in all four intelligences implies that learners had to include the use of computer programmes (*Microsoft Excel* and *Word*) to draw graphs and tables in order to record and organize number information, use

*Microsoft Word* to arrange their text logically using subtitles and paragraphs. All the learners were taught the different computer application skills before they started working on the open-ended digital learning tasks. Then scoring rubrics were used to evaluate the performance abilities in computer application skills that were demonstrated by the learners in their open-ended digital learning task documents and presentations.

#### 4.6.5.1 Logic mathematical intelligence

The overall intelligence profile of the learners in logic mathematical intelligence according to the results of the multiple intelligence survey questionnaire and school progress report was medium performance. The majority of the learners lie in the middle of the continuum, with 4 learners being high on one end of the continuum, 31 are medium and 5 are low on the extreme end of the continuum. The findings of the performance abilities of the learners in logic mathematical intelligence showed that 10 learners performed above average, 4 learners had medium performance and 26 learners performed below average. This means that there is a varied combination of mathematical abilities of the learners. The majority did not have preference in using graphs, or tables in their open-ended digital learning tasks. It could be possible that the use of charts and graphs is also associated with visual spatial intelligence, and that spatial relations in math are not stressed as highly as numerical calculations in schools. Hence, more learners do not have spatial abilities.

In a more refined process of identifying how the intelligence profiles of the learners affected the learners' performance in computer application skills, a contingency table was used. The contingency table had the intelligence profiles of all the learners in three intelligences (logic mathematical, visual spatial and verbal linguistic) that were assessed in the learners open-ended digital learning tasks products and presentations. Interpersonal intelligence was assessed differently using observations of learners over behavioural performances. The results from the contingency table indicated that 4 learners who had high intelligence profile also performed above average in the computer application skills in all the three tasks. Five (5) learners who had low intelligence profile also performed below average in the computer application skills in all the three tasks. Though all the

learners were taught all the computer applications skills together in class before the start of the study, learners who were strong in logic mathematical skills choose graphs, and tables for their tasks, while those who were low in logic mathematical did not use tables and graphs in their tasks.

Learners' intelligence profiles and their preferences affected the way they performed in their tasks. The results of the narrative stories of the selected learners support this finding. Coleman, who was high in his logic mathematical intelligence profile, also performed above average in all the tasks, and showed more preference in computer application skills with regard to logic mathematical intelligence. Not only that, performance abilities in logic mathematical intelligence were high even in his school progress report, where Coleman scored an average of 72% in mathematics, physics, and chemistry subjects. This shows that he could work well with numbers and has ability to work logically in mathematics and science subjects too. However, Coleman was weak in his interpersonal intelligence profile and also performed below average in interpersonal intelligence.

These results indicate that there is a relationship between learners' intelligence profiles and their performance abilities. The intelligence profiles of the learners can be a motivating factor to the preferences the learners make when solving a problem.

#### 4.6.5.2 Verbal linguistic intelligence

Learners' intelligence profile in verbal linguistic intelligence was high, where 16 learners showed to be high while the remaining 24 were medium. These are the results from the multiple intelligence survey questionnaire and school progress report. The results of the performance abilities in computer application skills indicated that 20 learners performed above average, 8 were average and 12 learners were below average. From these results, it shows that about half the number of the learners performed above average in verbal linguistic intelligence. This might mean that verbal linguistic intelligence is one of the intelligences that are traditionally valued and most of the learners work hard to perform better. These observations can be supported by the results from the assessment of the learners as they worked together in collaboration. Many learners assisted each other (peer

support) in order to complete the tasks; they also participated in oral presentation of their tasks where all the learners participated in the presentations. Moreover, learners also participated in the discussions after each presentation. Though some of the learners showed to be more elaborative than others (these might be strong in verbal linguistic), the discussions provided a platform for exchange of ideas and support of the decisions that were made in the different strategies used in the tasks.

The results of the contingency table shows that 13 learners who had a high profile in verbal linguistic also scored above average in their performance ability in computer applications skills in all the three tasks. The learners were able to use Microsoft Word document to type their texts, which were narrated in small themes and these themes were coherent. Other learners, (that is, 6 of them), whose intelligence profile was medium, had average performance, and none of the learners performed below average. There was a positive relationship between the intelligence profile of the learners and their performance abilities according to the results of the contingency table.

#### 4.6.5.3 Visual spatial intelligence

The intelligence profile of the learners in visual spatial intelligence showed that 4 learners were high, 35 were medium and 1 was low. The visual intelligence strength in the computer application skills was measured by assessing learners who have used different application skills in (*Microsoft Word* and *PowerPoint* presentation) programmes. For example, learners did use pictures from clip art, photographs, word art, colours, line animations and use of tables and graphs; 8 learners performed above average, 9 learners were average and 23 learners performed below average. It was found that there was no correlation when the learners' intelligence profiles, (medium and low profiles), were compared with their performances in visual computer application skills. Majority of the learners had a medium profile while they performed below average in their open-ended digital learning tasks.

The results of the contingency table indicated that from the 4 learners with high intelligence profile in visual spatial intelligence, 3 learners managed to perform above

average in their computer application skills in the three tasks. These learners showed preference in the use of clip art, word art, and photographs from their reading resources. Nine learners performed at average level in their computer application skills and also had medium intelligence profile. On the other end of the continuum, one learner performed below average and also had low intelligence profile. This learner did not use any visual application in his tasks. The task documents consisted of texts only.

The ability to use different computer application skills from the visual intelligence indicates that every individual possesses a unique profile of intelligences and particular area of strengths, which have to be appreciated in the assessment of learners' tasks. For example, from the selected stories that were discussed, Kim performed above average in the visual spatial intelligence, where he was able to use several computer application skills for visualization and a diagram was drawn on a manila sheet. Moreover, in Kim's school progress report the results showed that Kim had an average score of 75% in three subjects - biology, geography and computer studies. His intelligence profile was high in visual spatial intelligence and also he had high scores in subjects that are related to visual spatial intelligence.

#### 4.6.5.4 Interpersonal intelligence

The use of open-ended digital learning tasks allowed learners to use the computers in pairs, where comprehension and learning were facilitated and accelerated. Positive learning experiences resulted where learners shared their discoveries, supported each other in solving problems and worked collaboratively on the tasks. These skills are important in solving problems especially in real-life situations. The results of the study showed that 16 learners were high, 22 medium and 2 had low performance. Assessment of interpersonal intelligence was measured using scoring rubrics that were used during the observation process. Learners worked together to solve the problems, shared ideas, and peer coaching. During this process, most learners spent time in discussing and negotiating ideas that would be used in their tasks. Learners were able to make use of different computer application skills and even others who where strong in interpersonal

intelligence took the initiative to teach others. Sharing and peer coaching as one of the benefits of collaborative learning.

The positive performance of the learners in interpersonal intelligence was well demonstrated by Abigail as was narrated in the selected stories. The strong ability in interpersonal intelligence is supported by the results of the observation checklist, in which Abigail scored 3 points (high profile) in interpersonal ability. Abigail cared for her friends and was ready to help; she also showed high performance in leading her team.

If open-ended digital learning tasks can be used effectively in a classroom situation, then learners can get access to use their knowledge, skills and contributions in a varied way using their different strengths and weaknesses in the different intelligences.

### *4.6.6 Synthesis*

These open-ended digital learning tasks provided an insight into the learners' varied abilities to pursue logic mathematical, verbal linguistic, visual spatial and interpersonal intelligences. The learners worked through the tasks to reach beyond presenting a text, but used different ways of presenting their answers from texts, pictures, drawings, presentations, and discussions and also managed to work collaboratively in a team. By using non - scholastic intelligences as the main measure of performance, it offered learners different ways to learn and show what they know.

All the tasks and presentation documents that the learners produced, and were assessed revealed learners' combination of performance abilities. The unique performance abilities that were exhibited by the learners showed evidence of how each individual possesses strong and weak intelligence profile. For example, Coleman's strong performance abilities were across several intelligences (logic mathematical, visual spatial and verbal linguistic intelligences) in each task he did. Other learners however, had a single strong intelligence and were weak in the rest of the intelligences. For example, Abigail, was strong in interpersonal skills, Rachel in verbal linguistic skills and Kim in visual spatial skills. These stories provided the basic findings on how open-ended digital learning tasks

encouraged them to have their own preference in completing their tasks. The stories did not only describe how the learners worked on their strong intelligences, but also included the use of other intelligences, which on the other hand learners showed to be less comfortable with. For example when the learners where required to write their text documents, all the learners had to summarize their texts, to be used during the presentation session. Each learner showed a unique profile of how each intelligence manifested in his or her tasks.

What was important in the findings is that learners managed to use different computer application skills according to their performance preferences which could not have been distinct in a normal classroom activity where learners are assessed using paper and pencil test. Then learners did what they did because they exhibited different intelligence profiles and they made their own preferences on how to complete the tasks they were given; they did not necessarily have to give the same design of answers. There was a general image of the varieties of human capacity.

Therefore, a computer is a useful tool in accommodating multiple intelligences in open-ended digital tasks.