

*Full Length Research Paper*

# **The waste-bin: Not the last place to encounter technological knowledge and experience**

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**Often there is complaint about the lack of resources for the practice of technology education. Resources in this case refer to materials that are used in a technology education classroom or workshop. The stipulation from the South African education policy document (DoE, 2002:1) that learners should “identify and solve problems and make decisions using critical and creative thinking” can be exploited to create a solution to the shortage of resources through the use of waste-bin materials. Identifying or relooking at the waste-bin to find resources is a creative way of solving some of the resource problems in a technology education classroom or workshop. In this article, the waste-bin is seen as a niche area for technological material resources. While there are different waste-bins, there are also all sorts of different materials that can be found in a waste bin. An argument is made in this paper that “waste materials” should not of necessity be construed as wasted materials as these can still be reused. Three technological projects are undertaken using waste materials. The purpose is to prove that materials from the waste bin can be used for a technological encounter, knowledge and experience. A workshop was organized with 30 student teachers taking an advanced certificate in technology education course. Evaluation was conducted at the end of the workshop to establish whether the purpose of this study was achieved or not.**

**Key words:** Technology, technology education, waste-bin, waste material, scavenging, resources, critical and creative thinking.

## **INTRODUCTION**

In technology education the greatest shortage has always been resources. In some cases shortage of resources is relative. This was clearly articulated by Moore (2005) that every company (even in the UK) will at one time or another complain of shortage of resources. Unfortunately this has also been advanced as an excuse to get even more resources so as to have abundance or as a cover-up for failing to deliver. No company or organisation can shun being spoiled for choice when it comes to resources and materials. In fact, more is never enough.

There is a general limitation on the conceptualisation of the word “resources”. The general conception is to think of resources as materials and not human or physical resources. Human resources is often associated with the management of people or the placement of human beings in a company. The human capabilities such as the disposition to critical and creative thinking abilities are

often disregarded (Rossouw and Lamprecht, 1995). This paper focuses on the understanding of resources as materials and disregards all other interpretations as alluded to the aforementioned. As such, in this paper, the words materials and resources will be used interchangeably. I take for granted that the reader will understand that the materials referred to in this paper are “waste materials”. What then are waste materials and where can they be found? I understand the need to explain these as a crucial step to lay the foundation for the justification of the topic of this paper.

## **WASTE BIN, A SANCTUARY FOR WASTE MATERIAL**

A waste bin is often associated with discarded materials; those things that people do not need anymore. Of course

out of the waste bin we are able to find “waste materials” or resources that could be used in a TE classroom or workshop. The concept of “waste” is thus relative. However, the construct meaning of the term “waste material” needs to be unpacked to avert the derogation of technology education to “waste-bin technology education” for South Africa. It is my belief that using waste-bin materials will broaden the horizon to enable access to technology education by all. Access to education and to technology education in particular is often inhibited by the realities such as poverty, budgetary constraints and lack of resourceful thinking from the policy makers or the schools or even the teachers and the learners themselves.

In this study, the waste-bin is seen as a niche area for technological material resources. While there are different waste-bins, there are also all sorts of different materials that can be found in a waste bin. Some may be hazardous. As such, care must be taken when (emptying a waste-bin) or looking for materials inside it (a waste-bin). As “scavengers” of waste-bins, learners should be made aware about the dangers that waste-bin “scavenging” may pose precautions should be taken on how to ensure safety when looking for materials in waste-bins.

Waste materials are and have always been around us as epitomised by the simile of Adam in the Garden of Eden (Pudi, 2007). everything that is has been made from what was already there, except of course in the beginning when the Creator created everything from nothing.

That knowledge has been taken for granted. To reclaim this knowledge is to undertake a study of waste materials that are ‘all around us’ and how these could substitute the cry for lack or shortage thereof. To narrow the field where we want to identify and study waste materials, I found it prudent to begin at the “end-stage” that is the waste bin. In the cycle of material usage, the waste bin is considered the last stage.

That is why materials in a waste bin are often thought of as discarded materials which cannot be used any further. Consequently the topic for this paper is geared to reclaim the lost knowledge and understanding of materials that can be found in the waste bin, thus showing that the waste bin should not be looked upon as the last place to find materials for a technology education class. The waste bin itself is not a wasted bin, but a sanctuary and a repository for waste materials that can be used for technological endeavours.

### **Waste materials**

Waste materials are materials that have exhausted their purpose for one venture but can be re-used in other ventures. Waste materials can be deemed wasted in one venture but through innovation can be used in another venture. Often products and by-products of raw materials

in a production line are called waste when they cannot be used anymore or are not relevant to the line production at hand. What is waste in one production line may be used as raw material or input in another production line.

### **The term “waste bin”**

In this paper the term waste bin has been used both physically and figuratively. Physically the waste bin is a container where objects and things that are deemed unusable or useless are dumped in. These are remains or by-products of projects and processes. Figuratively the term waste bin refers to the surroundings. This is when waste is dumped into the surroundings, and then the surroundings become the waste bin or container. According to Learning Outcomes (LO) 3 in the (NCS) national curriculum statement (DoE, 2002:9), “All technological development takes place in an economic, political, social and environmental context”. Our surroundings can be our environmental, political and economic contexts. In both the physical and figurative use of the waste bin concept, the materials that are found “inside” are free.

### **Labelling, misjudging the essence**

Often waste-bins are referred to as rubbish bins and consequently the contents thereof are termed rubbish. Waste materials in a waste-bin are not rubbish as these can still be used. Waste materials in technology are material that are unusable in one situation but could be used in other situations.

Materials in use in a technology education classroom or workshop could be “waste materials” if they are by-products or off-shoots of some other materials, projects and processes. Based on the knowledge that not all that glitters is gold, it is logical and true that not all that is waste is wasted. Some waste materials can be re-used. Not all waste materials are rubbish or dust as could be implied from the synonyms of waste-bin, that is, rubbish-bin and dust-bin. Norman Peale (Peale, 1970) supports the assertion when he indicates the possibility of building a mansion with bricks that others throw away. Thus, if not clarified, labeling materials may curb us from realizing the real potential of using materials from the waste-bins.

### **Using waste materials as derogatory**

Unless the meaning and the justification of “waste materials” usage in the TE classroom is undertaken, the authenticity of using these materials may be undermined. The practice of TE may, like in the case of LEGO technology be deemed inferior. Some TE practitioners with specific reference to Potgieter (1998) are critical of

LEGO technology. There is a contention that LEGO technology does not promote critical and creative thinking skills in the learners. This is because LEGO is based on trial and error practice in which the solution to the problem does not lie outside the given resources. The shortcomings of some of the learning theories such as the Pavlovian operand behavior and the example of a monkey that joined sticks to extend its reach for an apple (Phillips and Soltis, 1985) have been compared to LEGO practice.

Searching for materials is part of the solution to the technological problem – something that LEGO does not promote. Instead LEGO is perceived to be unreal as it only simulates the real situations.

Whilst there is a belief that the use of real materials in technology classroom are preferred over LEGO, the reality is that these are not always available to everyone every time as alluded to in the introduction. Usage of waste material then becomes handy because these are readily available. Like real materials, waste materials have the ability to achieve specific outcomes of TE.

### **Knowing where to find waste materials**

Finding waste materials to use in a technological class may be just as fun as using these materials to achieve technological outcomes. Consistent with Sternberg (1985) that the first step in problem solving is to find if there is a problem, knowing what materials are required and knowing where to find them is similarly the most important step in a technological experience. But according to NCS (DoE, 2002:9) as mentioned earlier, “all technological development takes place in an economic, political and environmental context.” The waste-bin may provide all the contexts as mentioned, that is:

#### ***Environmental***

What is in the environment can also be found in the waste-bin. Waste bins are found in the communities and societies in which we live. Waste bins depict the way we live; economical or wasteful.

The contents of the waste bins could be analysed to tell where it (waste-bin) comes from (political). Thus waste-bins to some extent can be used as demographic compasses. This is knowledge that in some cases may be declared “absurd” or taboo especially in a climate of the prevailing democratic principles and values.

It is true that not all waste-bins are the same. But the most striking reality is that waste-bins can be demographically oriented. A waste-bin in an urban area such as Sandton (an affluent area in South Africa) cannot be compared with the one in a rural area. In technology education, the concern is more on the outcomes irres-

pective of what materials are being used. Thus the difference in the waste bins, if compensated by the teacher’s creativity will not matter.

### **How much knowledge lies in the waste-bins**

A mind that is not being used is a waste-bin. It is a sanctuary of knowledge and potential that has come to nought. To reclaim the knowledge that is lodged in our “unused” or “wasted” brains, we have to develop new ways of looking at old beliefs. The belief that a waste-bin contains ‘waste’ or wasted materials that have no use whatsoever should be reviewed. The waste-bin should instead be seen as a beneficial resource for technological practice in the subject of technology education in the general education and training (GET) phase. It should be seen as a storehouse of materials that can make it possible for a technological encounter or experience. It can also be seen as an inclusive strategy to enable the practice of technology by all.

### **Waste bin as an inclusive strategy**

The waste-bin is an inclusive strategy to ensure that all learners have the opportunity to take part in technology education. If waste materials were not to be used for some technology education projects, a lot of learners, especially the ones from poor communities would be deprived of the opportunity. The opportunity cannot wait until the budgetary constraints are overcome and we have sufficient resources or money to buy material resources. That time will never come as there will always be a shortage of resources (Moore, 2005). In line with the notion for a better life for all, technology and technology education should be made accessible to all. “Technology for all” is one concept that was geared to advocate this notion. A Technology Education book titled *Technology for all* (Bosch, 2001) failed to provide content that could be used by both rural and urban learners. It has instead conformed to activities and examples that are only relevant to the urban setting. As such, it has fallen short of the inclusivity strategy. Inclusivity is a democratic value and is discussed in the manifesto on values for education (DoE, 2001). Waste bins if they are to play a role in the implementation of technology education they must themselves be available to all. Because waste bin materials are free of charge, they can be accessed by all. This is not withstanding the fact that there are differences in waste bins such as alluded to in the expression of waste bins as demographic compasses.

### **The content and the context**

In choosing a technological solution, the costs and bene-

fits of the choice must be taken into account. There is a need for TE practitioners and learners to understand the interconnectedness between science, technology, society and the environment (Solomon, 1993; DoE, 2002). While technology may be the content, society and the environment are contexts within which this technology needs to be practiced. It must also be noted that the context of technology is itself not bias free. Technology influences values, attitudes and behaviours (for example, around gender, race, ethics, religion, culture, urban and rural). When scavenging materials from waste bins, it is necessary to develop certain skills, as a precautionary measure. Safety and ethical practice of technology education are of paramount importance.

### **In hunt of waste materials**

Like hunting and fishing, scavenging is also a skill. Like both hunting and fishing, scavenging can be dangerous. When scavenging, the scavenger first ensures that the prey is dead. This is a safety precaution. A dead prey does not pose any danger to the scavenger. Scavengers not only know what to scavenge but also know where to scavenge. The scavengers for TE should also know the art of scavenging for materials. For example, waste bins from hospitals should be avoided at all costs. It is tempting when one comes to think that used syringes can be found in the hospital waste bins and that these are handy in the demonstration of hydraulics. However, tyre repairs shops are very fertile grounds to pick up scarce materials such as used valves that could be used in pneumatics. As for pieces of wire and card box and news papers, these can be found in most waste bins. It must be stressed here that the best and safest waste bin that a TE teacher or the learner can scavenge is his or her own waste bin at home. In fact, it has proved to be a good skill to scavenge materials before you throw them in a waste bin yourself. Waste materials can be those materials that we (ourselves) throw away.

### **METHODOLOGY**

The focus of the study depends on the possibility of using waste materials to achieve certain learning outcomes in TE. Because of this, both the quantitative and qualitative approaches have been used.

The possibility of using materials for TE projects could be approached in a quantitative manner while the achievement of learning outcomes LO for TE as a product of the respondents' interrogation with the waste materials can be approached from a qualitative point of view. Unfortunately the qualitative approach would make imperative demands for techniques and data collection instruments that are consistent with this approach such as the interviews as the techniques for data capturing. Interviews dealing with 30 participants would be cumbersome and may lack the depth and richness that are to be expected of the qualitative approach.

### **Sampling**

The study undertaken comprised thirty student teachers doing the

Advanced Certificate in Education (ACE) in TE at the University of South Africa (UNISA). The group was selected from a sample of 302 students teachers that came to do the practical as part of their requirement to complete the ACE. Randomization was conducted to select the 30 students out of the 302.

### **Waste bin intervention**

This was accomplished by organizing a three day TE workshop for TE student teachers from UNISA. The intention of the workshop was to investigate student teachers' reception of waste materials as used in a technology workshop. Buying materials for 302 students is quite expensive unless waste materials are used which would achieve the same (intended) outcomes.

### **Project and briefs**

Prepare several technological projects in which the learning outcomes can be achieved through the use of waste materials. The project topics focussed on the construction of structures from waste materials. A plastic box full of waste materials was brought to the workshop. These waste materials had been meticulously selected by the researcher for this workshop. The waste materials that were placed inside the plastic materials box included: cardboard boxes, newspapers, pieces of wire, pieces of wood (planks), sticks, stones, sand, snuff tins, empty coke cans, plastic water bottles, empty margarine containers, rubber bands and others. Extra materials were given with the clear intention of giving the participants a choice (not really to confuse them). Because of the assumed higher level of cognition in the teachers, the materials were not selected for them for each project. They had to search for the appropriate construction materials from the materials provided in the box. This is simulation of the real life situation where materials are not selected or put together for the individual. Bringing different materials together to do a specific project is an act of creativity. The plastic materials box that I provided acted as a physical waste-bin. Tools and equipment were also provided. These included a hammer, long and short nose pliers, scissors, stapler, sello-tape, glue, a ruler, coloured pens and centre punch and nails.

Participants were requested to work in groups of five. Six groups were formed. Interestingly, only five participants were males as a results, there was one male in each of the five groups. The sixth group was only females. The projects undertaken were the following:

#### ***Project 1: Structure: Design and make a hat for a special occasion (Group activity)***

**Brief:** Design and make a hat for an occasion from the waste material provided. This could be any kind of a hat such as a hat for a special function or ceremony, or simply a sun hat, a rain hat or one for cold weather. There can be as many reasons to design a type of hat as there are occasions.

#### ***Project 2: Structure: A toy project (Group activity)***

**Brief:** (shortage of toys at a crèche). A creche in the vicinity approached you as a TE teacher to make toys for the children. Use waste materials and build a sample of the toy to solve their problem.

#### ***Project 3: Creativity with a piece of wire (Individual activity)***

**Brief:** Participants were requested to work individually and make

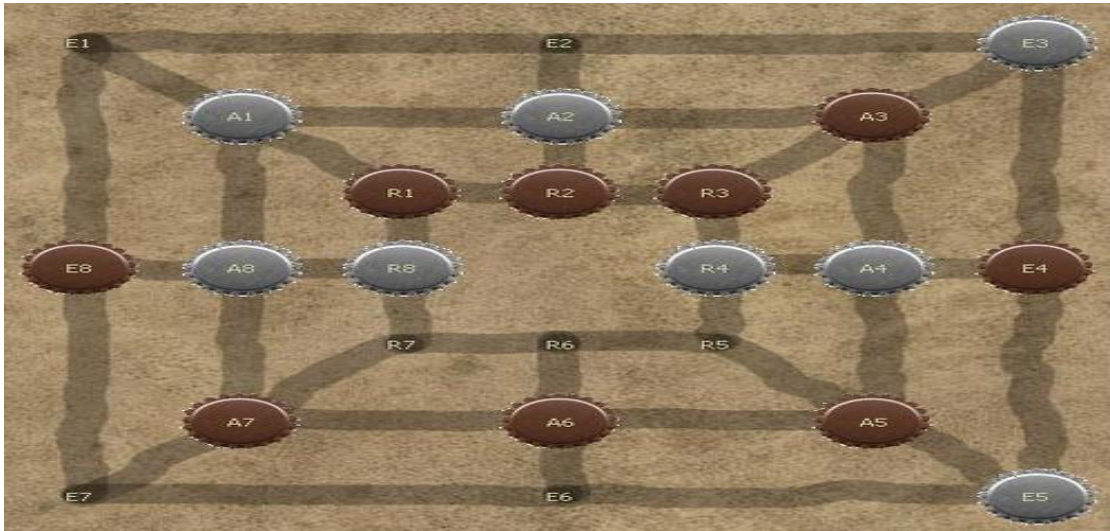


Figure 1. Morabaraba.

use of the pieces of wire provided to make some creative technological artefacts.

### Projects and activities

All projects were undertaken with a high measure of enthusiasm.

**Project 1:** There was high activity and a high level of noise as each group went about trying to fathom the brief and to design the solution to the problem according to the brief by using the Technological Process (TP). As this was a group project, each group was supposed to come to a consensus of a type of hat that the group would design, make and present. Two of the six groups produced two types of hats each despite the ruling that one type of hat had to be produced per group. When asked, I learnt that it was because they found it hard to choose the best between the two designs and as such decided to present both. Besides, enough waste materials were supplied. It is humanly possible to differ it is also difficult to make a compromise. It is also difficult to make a compromise between two good choices. This situation to some extent may have demonstrated that.

All groups made their presentation of the hats by following the steps of the technological process. The two groups which made an extra hat were also allowed to present them (the extra hats). Though I might have been pressed for time, refusing the presentation of the extra two hats would have done more harm than good. The high motivation and enthusiasm and the freedom and excitement of having made a contribution would have been the first casualties. Besides, the focus of the study was on proving that something beneficial can be done with the materials from the waste-bin. This being the case, the extra hats were not interfering with the focus of the study at all. In the end, there were eight different types of hats made. This included the Basotho hat and a clown's hat.

**Project 2:** The same type of competition as ensued in project 1 was also experienced here. Different types of toys were made. Fortunately only one per group was made this time. These were the toy car, a doll, a toy boat, a game of 'morabaraba' and a kite. The game of 'morabaraba' was made by drawing lines on a piece of hardboard and arranging these in the form of triangles and

rectangles (Figure 1). The group used the bottle tops as pons ('dikgomo') to play the game. This game is more like snakes and ladders but is an old African game that was played by men and boys. It is usually drawn on the ground and men play it to recreate or to take breaks from their daily activities. Boys play these to break the boredom during cattle herding. Though the thought of 'morabaraba' was good in that this is not only a toy but relates to indigenous technologies which are a great scarcity and necessity, the big question was whether it is really suitable for children in a crèche. For fear of losing focus of the purpose and intentions of this study, I will not discuss, nor elaborate on the questions and arguments about these artifacts with specific reference to this one of 'morabaraba'.

**Project 3:** Because this was an individual activity, 30 different designs were expected. Instead more were done. While this project also focused on the use of waste materials, clearly the participant's creativity was brought to the fore. The presentations that followed were equally very creative. Some of the creative artifacts made included a vase (for flowers); an egg beater; a golf club; spectacles; a bulb (with plastic around it to represent the glass part); a crank and letters of the alphabet. The crank and the letters of the alphabet provided good argument points. It is interesting to have noted that the crank was made by a male participant and that it was intriguing to many of the female participants as they struggled to understand how it works. "You see, when you turn the steering to the left the wheels go to the right..." the male participant explained. He further gave an account of what can be done: "to make the wheels to turn in the same direction as the steering. The letters of the alphabet "A", "B", "C" and "D" were designed by a female participant. She revealed that this is usable when you have to teach the foundation phase or grade one learner the letters of the alphabet. Her ingenuity reminded me how TE and this very aspect can be used to integrate with the learning area of Language Literacy where learners are taught the letters of the alphabet.

After the completion of the workshop, a questionnaire was administered to the participants to evaluate the three day workshop in two methods. The first part of the evaluation questionnaire asked the participants to rate the intervention or workshop for

**Table 1.** The 5-point Likert scale responses for each category.

<b>Category 1: Workshop organization</b>					
Scale	1	2	3	4	5
Responses	0	0	4	13	13
<b>Category 2: Relevant materials for workshop</b>					
Scale	1	2	3	4	5
Responses	0	0	11	12	7
<b>Category 3: Achievement of learning outcome</b>					
Scale	1	2	3	4	5
Responses	0	0	9	13	8
<b>Category 4: Ability to use waste materials at schools</b>					
Scale	1	2	3	4	5
Responses	0	0	4	15	9

organization, materials usage, achievement of a learning outcome and relevancy on a 5-point Likert scale where 1 = very poor; 2 = poor; 3 = uncertain; 4 = good and 5 = very good. The second part was made of open-ended questions which asked for free responses and comments in written form.

## ANALYSIS AND INTERPRETATION

In analysing the responses of the workshop participants, I found it prudent to use tables. Besides simplifying the problem or situation, tables have an added advantage of giving you a bird-eye's view of a situation. Tables are handy in arranging information such that it is easier to see the connections. It also provides for a quick reference and saves 'a thousand words'. When interpreting information, connections and correlations are necessary. Through these gaps, shortcomings and limitations can also be easily discerned. Thus analysis of information or a situation by means of tables makes interpretation easier.

The 5-point Likert scale responses for each category were captured and represented in Tables 1 and 2.

### Reducing the 5-point Likert scale to the 3-point scale

In order to simplify the analysis of the responses, it is better to reduce the 5-point scale to a 3-point scale. The 3-point scale is easier to work with than the 5-point. This reduction will require that the responses be grouped. The grouping of the responses will be as follows: 1 and 2 will be put together; 4 and 5 would also be put together while 3 remain the same. 1 and 2 signifies very poor to poor and can be put together under the umbrella for "poor"; 4 and 5 signify good and very good and can be put under the same umbrella for "good"; 3 signifies uncertainty and

will remain as "uncertain." Table 3 shows the reduction of the 5-points Likert scale to 3-point Likert scale.

### Part 1: Summarizing the responses based on the 3-point scale

In category 1 (workshop organization): 26 respondents (86.7%) feel that the organization of the workshop was generally good (a combination of good and very good). The effect of the 4 neutral respondents is insignificant and can be ignored. Besides this would not make any difference to the overall impression even if they were to be casted into either of the categories "poor" or "good".

In category 2 (relevant materials for the workshop): nineteen respondents (63.3%) believe that the materials used in the workshop were relevant. Eleven respondents (36.7%) are uncertain while no respondent feels that the materials were actually irrelevant or not useful for the workshop. The fact that the designated projects were completed using these materials is perhaps the reason why there is no one who feels that these were 'totally' irrelevant. The 11 respondents who registered responses of uncertainty could be due to the fact that they feel that the materials, though relevant were limiting when one takes into consideration that the only materials were those selected and collected by the researcher and placed in the big plastic container. For sure, outside the workshop and in the community more materials could be obtained. Thus materials in the container in the workshop resembled to a large extent the researcher's choice and view and are thus in real terms biased and may be limiting. No respondent reported 'poor' in this category which confirms that though probably biased and limiting; the materials were in the respondents' opinion not irrelevant at all.

In category 3 (achievement of a learning outcome):

**Table 2.** Putting the attitude responses together.

Scale	1	2	3	4	5
Category 1	0	0	4	13	13
Category 2	0	0	11	12	7
Category 3	0	0	9	13	8
Category 4	0	2	4	15	9

**Table 3.** The 5-point Likert scale reduced to the 3-point scale.

Scale	1 and 2	3	4 and 5
Category 1	0	4	26
Category 2	0	11	19
Category 3	0	9	21
Category 4	2	4	24

twenty one respondents (70%) believe that the materials enabled them to achieve a technology education outcome. There is vagueness as to which outcome was achieved as there are three learning outcomes in technology education. Whilst the study focused on the use of waste materials to achieve technological ends, the projects were focussed on the implementation and not necessarily on achieving a specific learning outcome. However, a thorough analysis of the three projects revealed the possibility of achieving all three learning outcomes through each or all of these projects. The only restriction is that these projects were all focused on structures while other areas such as pneumatics, hydraulics, electricity were not brought into the picture. The three learning outcomes for technology education are:

- 1) Technological processes and skills (Learning Outcome 1). This outcome stipulates that learners should be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies.
- 2) Technological Knowledge and Understanding (Learning Outcome 2). This outcome stipulates that learners should be able to understand and apply relevant technological knowledge ethically and responsibly.
- 3) Technology, society and the environment (Learning Outcome 3). This outcome stipulates that learners should be able to demonstrate an understanding of the interrelationships between science, technology, society and the environment. It is clear that learning outcome 3 is consistent with using the environment such as picking the materials from the waste-bin or the environment as was the case with the materials brought and used in this workshop.

Nine respondents are uncertain about the achievement of

a learning outcome. Perhaps the uncertainty stems from the fact that they are not sure as to which specific learning outcome was referred to here. The projects as has already been explained had the potential to achieve all three learning outcomes. It is just a matter of the participant's viewpoint and creativity. One project can for example be used to integrate all three learning outcomes.

Category 4 (ability to use waste materials at schools): In essence this refers to portability. Will the respondent teachers be able to take the knowledge and experience that they have gained through this workshop and use it in their respective schools? Twenty four of the respondents (80%) believe that this is possible. In contrast, two respondents (6.7%) believe that this is not possible (Figure 2). Though 2 respondents may be insignificant in terms of numbers, it will be worthwhile to interrogate the possibilities of this viewpoint. First, the respondents may be in doubt as to their own abilities about transferring this learning encounter to another similar situation, in this case the classroom or workshop in a school. It is possible also that some schools have ethos that may be against learners picking and using waste materials. Needless to say that some schools could afford to buy these materials for learners to use instead of risking using materials from the waste bin which could, pose danger to the learners themselves. Besides the dangers of scavenging for materials in the waste-bins, this exercise may be time consuming. It is obvious that when scavenging waste bins one is not sure which materials one will find and in what quantity and quality. The choice of the materials for a project is a very important aspect together with the quantity and quality thereof as these depends on not only the learners in a class or workshop but also on what the project brief and specifications stipulate. While oversupply may not be a problem, shortages and incorrect materials could cause some learners the inability to do the project. In short, when you have the financial power, you have a wide choice of the materials, the quantity and quality and the good turnaround time of achieving your needs to complete projects. It is possible that the four respondents (13.3%) who registered uncertainty on the attitude scale may have done so due to the reasons stated above. Some of the programme at UNISA do not come from schools. They are still new teachers who are doing the course with the hope that they will one day be employed as Technology Education teachers in a school. Based on this, there is justification for uncertainty as these response are not attached to any school.

## Part 2: Summarizing open ended responses and comments

The open-ended question section of the questionnaire as divided into three categories that is, comments about the workshop; comments about the use of waste materials

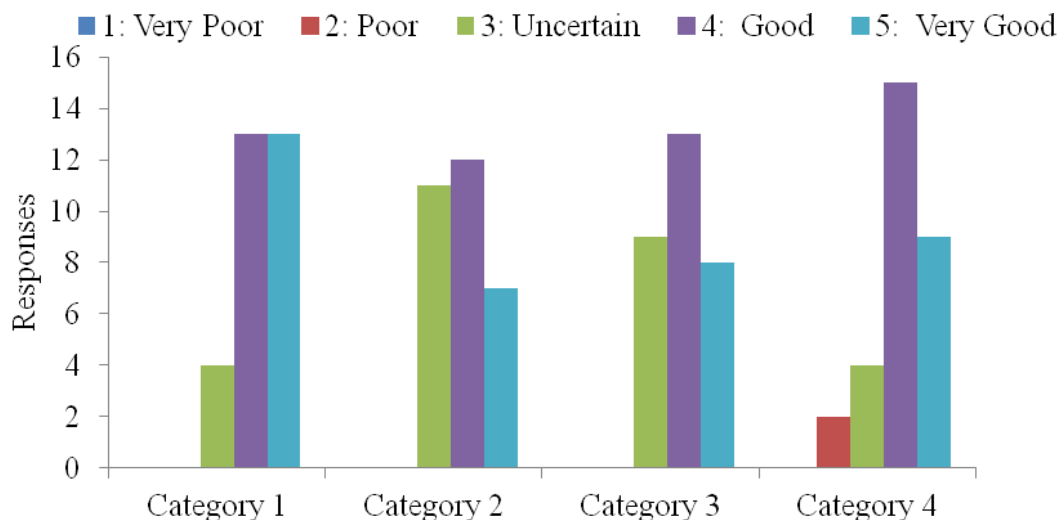


Figure 2. Graphical representation of the attitude responses.

and comments about areas that need improvement. There was no restriction given as to how comments should be made, such as the length of the comments. Instead, it was encouraged that further comments could be made on a separate sheet of paper and that additions can also be sent at a later stage on the address that I supplied. This was because some people may not have been in a good position to write down the comments to their satisfaction immediately after the workshop due to various reasons. Some may have been in a hurry to leave for their respective homes since this was the last day of the workshop and 'home – go' excitement and emotions may not have been conducive to a clearer, sober and honest comment or opinion about some aspects of the workshop especially when you have to sit down and do some 'creative writing'. Thus the timing may not have been conducive. That is why the extension was granted. After going through all the comments a summary of these were made. Finalization of the comments was done three weeks after the workshop as a means to give an opportunity for the late comments according to the extension invitation. I have to mention here that I received only one submission after the three weeks extension. Thus the summary for the open-ended responses will be made out of the comments that were made the same day after the workshop.

### Comments about the workshop

Consistent with Part 1, there was general agreement that the workshop was interesting and beneficial. Acknowledgement that the workshop has taught them something could be seen in comments like: *"Barriers were broken!"* *"It will now be easier to get along with TE tasks without having to worry about materials."* A

selection of other comments received also showed positive appreciation of the workshop. These include: *"I enjoyed the technology class" (I hope it meant workshop); "The workshop was well organized."* *"We learned a lot of things. We also had time to socialize."* *"I am sure that I will take some new information to my school"* *"We need more workshops like this one"*

### Comments about the waste materials usage

Cognisance is taken that comments about the workshop may influence comments about the use of materials (not mutually exclusive). Actually, the workshop was about the use of waste materials from the waste-bin. It is possible that a person that does not feel comfortable with the idea of using waste materials from the waste-bins in a (TE) lesson may not see any value for this workshop and will give negative responses for both categories. It so turned out that the comments that were made about this category on the relevance of waste material usage were far too many as compared with the comments to the other categories. The majority of these comments, as has been the case in the attitude scale were predominantly positive towards the use of waste materials for technological projects. While I represent the comments verbatim as retrieved from the forms, I will try to group them as positive or negative towards this category of waste material usage. The purpose of representing verbatim some of the comments is to offer a sample of the spirit that could have evaded me if I had to paraphrase the comments myself. I have to admit that this grouping is based on my understanding of what the response means and as such could in some instances be flawed. This is worsened by the fact that these comments



were not substantiated. Some of the positive comments supporting the use of waste materials are:

*"It is possible to achieve a lot of TE outcomes through the use of waste materials"*

*"I was never aware of the abundance of materials that I could get around my vicinity for free. I always thought that to do TE you need money to buy a lot of resources."*

*"The lecture showed us some creative ways of using waste materials for TE" (I want to believe that the term 'lecture' was supposed to mean lecturer)*

*"We managed to complete our briefs and achieved our outcomes with waste materials that the lecturer supplied."*

*"I am sure that I can collect these materials and use them myself."*

Some of the responses that show a negative attitude towards the use of waste materials are:

*"My feeling is that children will not develop, beyond using waste if they are taught in waste. That is like telling them that life is about waste materials."*

*"Using waste materials is a wasted effort. It is waste of time because in life we do not use waste materials but real materials"*

*"We are now in a world of high Technology, waste materials have no place. Look at the digital watch; you don't repair it when it is broken. You simply throw it away." (I assume that High Technology refers to Hi Tech).*

*"Waste is waste...finish and klaar!"* (This comment gives an impression that nothing can be done with waste. So the purpose of using waste materials is a futile exercise.)

*"No money to buy even tools and equipment. No support from principals. Some projects (and LO's) cannot be achieved through the use of waste materials. Only structures were done today. I don't think that we can achieve the same success with other projects for example, pneumatics, electricity, mechanics (gears) etc. – you do not find such materials lying around in the street or, do you?"*

### Shortcomings observed

While the study was about 'looking at the waste-bin' to find materials to use for technology education, there are obviously some shortcomings. From the participants' point of view after the workshop, comments were made that pointed to the shortcomings of looking into the waste-bin to find materials to conduct technological projects for a technology education lesson. Some of these will be represented verbatim.

*"I doubt if we can achieve other learning outcomes by using the same materials."*

*"All you need is to be creative."* (The implication is that there is everything in terms of materials from the waste-bin). *"Picking up materials from the dust bins could be a*

*problem for learners" (I assume that 'dust bin' means waste bin)*

*"Both learners and teachers are not ensured against the danger of the waste materials" (believe that reference is made to the collection of waste materials from waste-bins as being a safety hazard/risk).*

*"I don't think that the department will allow this."*

*"I am not sure if waste materials will work in other TE projects and outcomes."*

*"I don't think that waste materials will be used in other subjects/learning areas such as Home Economics where cooking is involved."*

*"Maybe that is why there was an attempt to delete TE from the curriculum."*

### FINDINGS AND RECOMMENDATIONS

Because of the small number of participants (30), the findings of this study cannot be generalised or inferred. However, the response and comments from both parts of the questionnaire can be interlinked to create a meaning. Suffice to say that both the first part and the second parts of the questionnaire supported each other well. It is good to note that all the questions were responded to. Some were difficult to read whilst others were difficult to make sense of as some of the respondents have written in short hand. This could have been due to the lack of space provided or simply because of the habit of writing in SMS (as is done when writing cell-phone messages).

Findings about the workshop indicated a high level of satisfaction. One comment alluded to the need to organize more workshops of this nature. Based on the findings of both part 1 and 2, it is safe to say that the general impression is in favour of waste materials being used for technological projects. Despite the general happiness and appreciation, there were feasible doubts raised pertaining to the use of waste materials. The comment that learners who learn in waste may think that life is about waste is another specific comment that was interesting to me personally. It is corroborated by the comment that life should not be seen as all about waste. In the category of shortcomings observed, the concern about safety was legitimate.

Overall, the responses showed positiveness towards the use of waste materials. It is indisputable that the three projects focussed on structures and that other topic such as pneumatics and electricity have been left out. The truth of the matter is that the purpose of this study was to demonstrate that the waste bin can provide materials which could be used for a technological experience. By using structures as examples thereof, the study has successfully demonstrated the truth of that assertion in the topic and focus of the study. The title did not specify which topics to use (for example pneumatics) to investigate the problem for this study. This then is another way of justifying the use of only structures. Of

course other studies may be conducted which could focus on those topics that have been left out including of course "home economics" as this was also raised on the topic of shortcomings observed.

### Limitations of this study

Because of the small sample size (30), the findings of this study cannot be generalised or inferred. The somewhat qualitative nature of the study as can be elicited from the 'free' responses does not offer the real thickness of the description of events as would be the case with a pure qualitative study using the technique of interviews (Mouton and Marais, 1993). Interviews have an added advantage of probing deeper into issues and of making follow-up questions which these written 'free' responses are unable to achieve. According to Vockell and Asher (1995), this type of study is similar to the "one sample post test study" which represents a very weak study indeed. However, lessons learnt from this study can be exploded and magnified as a basis to investigate deeper some of the matters raised.

### Conclusion

If the waste-bin is not the first place to look to for technological resources, maybe it is the second or third, but definitely not the last one. Technology is the use of everything that is possible in order to meet the needs and wants or to improve life within ethical and safe practice. There is so much knowledge in the waste bin that still needs to be reclaimed. The waste bin can be converted from being a 'wasted bin' to a storehouse of technological encounter and experience within ethical and safety measures. The three projects conducted with waste materials as demonstrated above is full proof that a lot of knowledge can be created through the use of waste

materials that can be found from the waste-bin, both figurative and physical. It is thus befitting to make an analogy with the advertisement of OMO washing powder that says we have to look at dirt differently... "because dirt is good" The goodness of the waste-bins as a supplier of materials for the practice of TE has been demonstrated albeit with projects on structures only. It is thus befitting that we have to look at waste materials and the waste-bins differently because 'waste is good'.

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