Assessment of the MAKING stage in Technology – why we don't give the model a mark

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The problem we address in this paper is that in many schools Technology is seen as a handwork and crafts learning area, in which learners "do technology" if they make something. The actual making is often given as homework. Assessment is also seen in a simplistic way – a learner may be given a mark based on the appearance of the product or model. Models that are large, neat and nicely decorated tend to get higher marks than those that are not so neat, or use cheaper materials.

This approach to model-making and assessment misses some vital issues that can make Technology a very productive learning experience for teacher and class. We take up these issues in this paper.

Introduction

The Technology for all Intermediate Phase Pilot Programme (TFAPP) works with seven schools currently, putting the NCS Learning Area statement to trial and attempting to do all that it expects for Grades 4 to 7. We use a common course in the *Technology for all* books developed by Setlhare Trust, and meet every two weeks to review the previous lessons and prepare for the coming ones.

Out of these shared experiences and classroom follow-on, we have developed a position:

First, we think it is essential that children do their model-making in class, and not at home. (This raises issues of organisation and resources in the school.)

Second, we do not give a mark to the model as such, and do not report on the model itself.

Third, we use the model to find evidence of the learners' progress in skills and technological understanding. The model helps us make inferences about the learner's competence.

Making the models in class

The schools in the TFAPP project have no specialist technology rooms, and the making-stage of each project takes place in an ordinary classroom. We do make special efforts to ensure that there are plenty of materials and enough appropriate, simple hand tools.

Our experience in a couple of schools, where parents wanted to have a hand in making the models, to ensure a good mark, made us realise that unless the model is made in class, most of its learning potential is lost. Furthermore, the Assessment Standards for Learning Outcome Tech1 ask us to assess the skills of the learner, and this is hard to do if the making-stage of the project does not happen where we can observe at least some of the learner's skill.

The reasons why we don't give the model a mark

- A model may represent someone else's work. Children can and should learn from their parents or older sibling, but in this case we can't be sure what the child has learned.

- The basis for giving a mark to the model is shaky. Imagine we have two models: a beautiful one from a child whose parent has a workshop and willingness to help his child, and a very simple model from an orphan child whose home is bare, with no adult in it. On what basis are we going to mark the two models?

- If it becomes a general practice to mark the models themselves, this will raise issues of equity and commitment in a set of schools. Imagine two schools – one has a well-equipped workshop with electric tools, workbenches and spray-paint, the other has none of those. The models from the first school will usually look better than those from the second school, and will be assessed more highly. Schools without those facilities could well opt out of model-making and teach Technology theoretically.

- A good-looking model does not equate to good learner skills for all the reasons above and more importantly, a model that did not work out as the learner hoped may have evidence of highly developed skills. For example, a learner may have had a clever, ambitious design but the model was too complicated to make, or she lacked the right materials or tools to make what she intended to make.

For all these reasons we don't try to give a mark to a model, and we do not view the finished model as the "final exam" in a technology project.

So why make models at all?

The value in model-making lies in the motivation and sense of pride that it can produce in learners; this motivation in turn makes it possible to assess the **best** that the learner can produce. Unless one sees the best that a learner can do, one cannot make a valid judgement of the learner's competence.

Each project in the *Technology for all* course generally needs a whole term to complete, and we find that the stories which structure each project engage the learners, because they look forward to the model-making stage, which comes a few weeks into the term. Thus we are able to assess their abilities as they **investigate** the problem, or existing products, or techniques they might need, or concepts they will have to apply. We are able to assess learners' thinking about possible **designs**, and the depth of their **evaluation** and **communication**, because the model-making has created a focus for all these components of the project. Along with these aspects we see learners in debate, learning from each other, learning about co-operation and compromise.

So, instead of giving the model itself a mark, we use the model to find clues about the learner's thinking and make inferences about the learners' Tech1-MAKE skills and their Tech2 knowledge. The models give us clues about the learners' ability to apply their knowledge from investigations, clues about their design reasons, clues about whether they understand the need in terms of "People, Purpose and Place" (where "Place" refers to environmental impacts). [1]

The model gives us clues about the learners' construction skills in measuring and marking, shaping and cutting, joining and strengthening, finishing and decorating.

We can look at the model and ask the learner, "Why did you design it this way? Did you change your mind about your design, and why?" Or we can ask, "Can you think of a way to make this part stronger?"

Figure 1: *The 2-D model of a chicken that Neo made.*

A practical example

Now we look at an example from a project that the programme schools are currently doing in Grade 6. The context is that the learners are making a model animal; they will use it as an aid to tell a traditional story reflecting some indigenous knowledge. The animal must have a moving mouth (i.e. they are learning about mechanical systems) and must stand by itself (i.e. they are learning about structures).

Figure 2 *Neo's chicken has to tell a story and so its beak opens . . .*

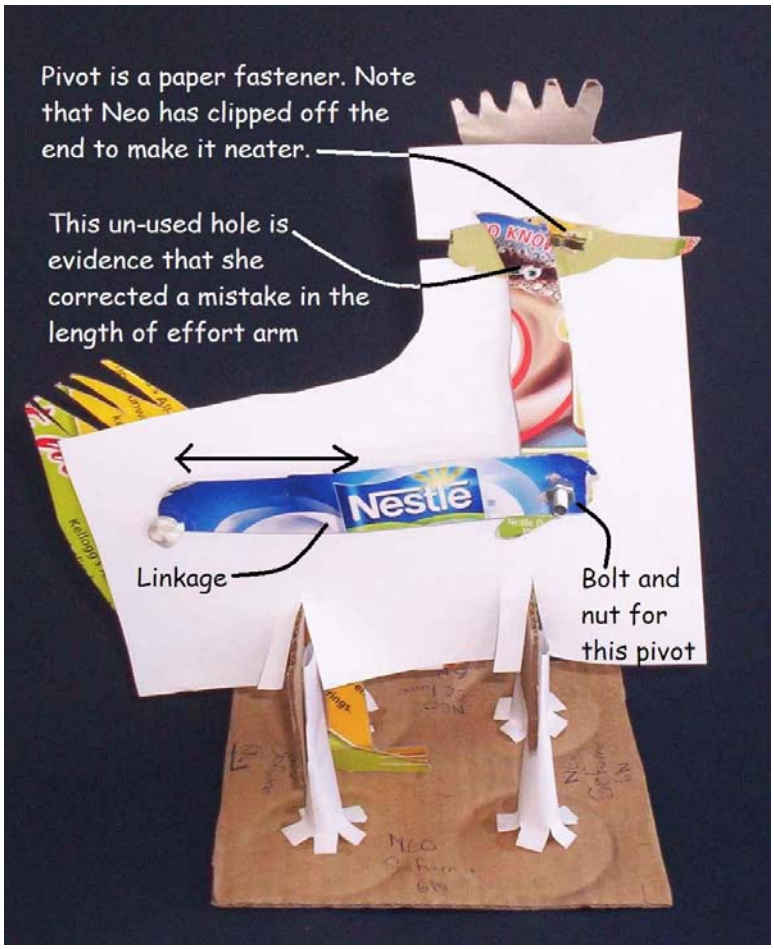
Figure 3 *. . . and closes.*

What clues do we get from the model about what Neo can do? And what feedback can we give her?

1 **What do we see, that is evidence of her measuring and marking skills?** Measuring is not always a matter of using a ruler; we may see it in the sense of proportion, or the way the learner uses appropriate sizes for parts. The animal's head and body are in proportion; the lower beak matches the upper beak. The legs are not too long and they are equal in length. (Alright, a chicken does not have four legs but Neo saw that her original design was not going to make the chicken stand up by itself so she improved the design. The improvement is solid and she knows quite a lot about structures.)

Figure 4 *This is what the model looks like at the back.*

Figure 5 *This is the detail of the beak lever and its linkage.*



Now look at **Figure 5** the beak lever, and the linkage that works it. She had to measure and mark these pieces so that they fitted neatly behind the body of the chicken, and they remain hidden while her finger works the linkage, out of sight of the audience.

Near the top of the beak lever, we can see a small hole; probably she first placed the pivot there and found that the lower part of the lever had to move too far. We should ask her about this, to make sure. But her mistake means she has learned something about measuring the arc through which the beak will move.

2 What feedback can we give her about cutting and shaping?

(a) Neo knows how to draw on paper and paste onto cardboard, and then cut both paper and cardboard at one time (many adults and children don't realise this is the efficient way to do it).

(b) The neat tail feathers and the rounded indentations in the comb on the head of the chicken are evidence of her care in cutting. She has learned to rough-cut the shape and then work with a small pair of scissors on the details.

(c) Notice the tight fit between the body and the vertical joiners. She has cut slits of the right width to make a tight strong halving joint between the thin card of the body and the thicker cardboard of the vertical joiners.

(d) All this work suggests she has patience and willingness to take her time to produce something good. She has pride in her work.

3 What feedback can we give Neo about her joining and strengthening?

(a) We noted the tight fit of the halving joints (in **Figure 6**) that she achieved by cutting the slits the right width in two materials of different thickness.

(b) She has cut slits in the bottoms of the legs and spread them out – this gives her a much bigger surface area for gluing the legs to the base.

Figure 6 *She has cut slits of the right width in the thin card and the thicker corrugated cardboard, to give her a tight-fitting joint.*

4 What can we say about her finishing and decorating?

Neo has not yet completed her model and we are doing formative assessment, which means giving her feedback from which she can improve; we are not yet doing a summative assessment of her skills. Thus far, from this model, we don't have much evidence of her skills in this area.

5 What can we infer about Neo's understanding of structures?

Assessment Standard Tech2-STRUCTURES asks about the learner's knowledge of structures. We see evidence that she understands structures at the Grade 6 level (at least):

- the legs are spread in an A-frame shape; they are not parallel. So she knows something about stability of structures. The base that the chicken is standing on is strong and large enough for the purpose.
- she has used paper, a fairly weak material, to make a stronger column by rolling the paper into a tube.
- she has cut "toes" into the legs to increase the gluing surface (we noted this above, already).

In Neo's case we have so much evidence that she understands structures at the Grade 6 level that a written test is hardly necessary.

What can we infer about Neo's understanding of Tech2-SYSTEMS (mechanical)?

Here we don't have as much evidence of her understanding but we do note that

- the lower beak is pivoted in the right place to get the appropriate amount of movement
- the small hole tells us that she has adjusted the pivot position; her positioning was not a lucky accident
- the linkage (which is hidden behind the body of the chicken, where the audience will not see it) moves horizontally and causes a rotational movement of the beak. The effort arm of the beak lever is long, which means that the beak moves quite forcefully, but not too far. The length of travel of the linkage is correct for the amount that the beak needs to open, while the linkage remains hidden behind the body.

Feedback and formative assessment

The emphasis in assessment in the *Technology for all* programme is on formative assessment; the essence of formative assessment is that a teacher helps learners compare their work against a standard; the standard may be in the mind and experience of the teacher, or in an example of good-quality work, or a set of criteria. The teacher interprets the learner's work to him or her through comments and questions so that the learner knows whether he/she is at the expected standard, or below it.

Formative assessment is a very active role for the teacher. Neo has produced a good model partly because her teacher did formative assessment when she was designing and making the model. He moved around the class all the time, noticing what the learners were doing and giving them feedback in the form of comments and questions.

The skill and craft of the teacher is to judge the kind of comment or the level of question to give the learner. Feedback can be in the form of questions like "I see where you want the jaw of your animal to go, but now you have not left enough material to make a hole for the pivot. Can you sketch that jaw again and show me where the pivot hole will go?"

Or "You have a nice wide rotation of the jaw; I see you have to move the linkage a long way to get that much rotation. But you could improve it so that a small movement of the linkage causes a bigger movement of the beak. Please try it again, and then show me."

Formative assessment need not come only from the teacher; the teacher can organise learning so that children learn from each other. Children look at other children's projects and pick up ideas from them; in some Learning Areas this would be seen as cheating, but in Technology we regard it as another mode of learning.

An opportunity to practise formative assessment

In this photo you see the work of Grade 5 learners who were making a structure to shelter chickens and provide a safe place for them to lay eggs and raise baby chickens.

Look at **Figure 7**; The learners were given a "standard chicken" (a cardboard shape) to use as a reference to get the scale of everything on the farm correct. What do you notice about the feed-tray here, and what would you ask the learners who made it? [2]

Look at **Figure 8** on the next page; What can you infer about the learner's understanding of structures? [3]

Look at **Figure 9**; What can you infer about the learner's knowledge and skill in cutting dowels and joining the parts of a frame structure together? [4]

Figure 7 *The feeding tray for the scale model chickens*

Figure 8 *The inside view of a learner's chicken coop. What knowledge of structures does this learner have?*

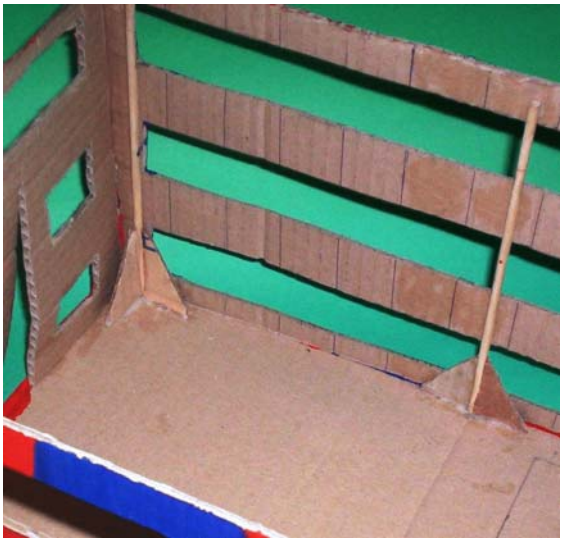
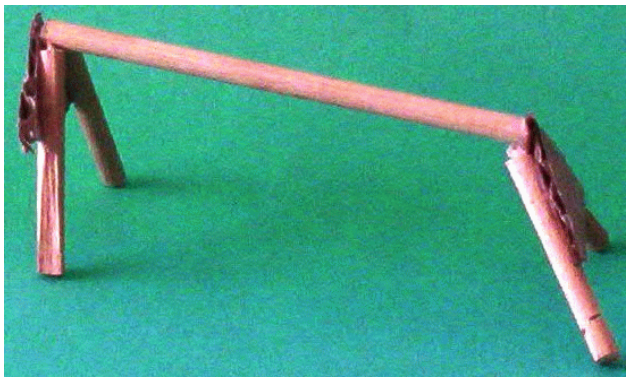


Figure 9 *A model perch for chickens to roost on. What knowledge of structures does this learner have, and what feedback will you give the learner?*



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Technology education - now more than ever Peter Middleton 2008 Proceedings of the SAASTE 2008 conference.

Endnotes

1 An assessment is always an inference about understanding or competence, even though people commonly think that an assessment is a measurement. We are not able to measure the understanding of a learner – we cannot look into his or her head – all we really do is make an inference about his/her understanding from what he/she produces. An assessor is in the position of magistrate who has to make a finding based on the evidence before the court. What we look for in assessment is good and sufficient evidence that a learner CAN do what we have tried to teach.

2 The tray is made to a bigger scale than the chickens. We can ask the learners: "Can your chickens reach the food? Did the group discuss the size the tray should be? Did you look at the size of the chickens before you made the feeding tray? What did you have to measure? Other feedback can be "I like the fact that you put some real seeds in the tray."

3 The learners have glued triangles of cardboard to strengthen the joint between the dowel and the base. The triangles have been cut accurately at 90° and as a result, the glue holds them to the base and to the dowel. (Many learners do not understand that if only one side of the triangle is glued, the triangle does not provide strength).

4 We could ask, "The legs did not support the weight of the chickens; think of a way to strengthen this perch." The learner understands that the triangles at each end hold the legs at the correct angle from each other, but has not realised that the legs need another triangle to hold them at right angles to the long dowel. The cutting of the dowels needs more practice; you see the learner cut only part-way through the dowel and then it broke off. Did the learners have a cutting board or clamp to hold the dowels steady while cutting?