

Should Process Skills be Replaced by Tactics and Strategies?

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It is important to give pupils the chance to take 'real' and personal tasks right through from start to finish. However, we also want pupils to focus on separate aspects, so as to grasp each securely and also to help assessment.¹ Sorting out these separate aspects has been a problem for teachers of technology (including home economics), design, and the investigatory and application phases of science teaching. In all these areas attempts have been made to divide the whole tasks or process into stages, which have been called 'process skills', (i.e. 'design skills' or 'investigatory skills').

Much has been built on this. Some teachers have considered teaching 'process skills' more important than teaching content such as science concepts, because they felt that pupils of lower ability can then succeed, and they have put aside the teaching of content. Many schemes of teaching and assessment have used 'process skills' as a basis for assessment objectives, sometimes with detailed subdivisions for grading.² We are beginning to see, however, that the theoretical basis for these skills is shaky and may need more thought. Several critical articles have appeared, especially in the science literature.³

Current Views: Pupils Can Do It Already

To summarise the view now put forward, pupils come to school already able to carry out 'process skills' such as observing, seeing problems, generating ideas, planning solutions, forming new concepts from observations, comparing two possible solutions, evaluating, etc. *We cannot therefore teach these abilities.* They seem to be part of an innate and maturing brain function. Indeed, they have been described in physiological terms by Changeux.⁴ This sort of ability must be *exercised* in school, but what do pupils actually *learn* in school, beyond naming the 'processes'? They certainly learn new *concepts* and can then observe, plan etc. *in terms of* these concepts, so that they immediately 'see' a phenomenon or situation as 'convection' or 'a problem of lengthening the lever arm'. As will be suggested below, pupils should also learn new tactics.

Disagreements over the Process

Another argument against 'process skills' comes from comparing the many attempts that have been made to analyse the whole process and divide it into design skills or investigation skills. These different analyses vary widely. Some teachers suggest in effect a totally different overall process or strategy, and some suggest extra stages or a cyclic process, or add several cycles. Attempts also vary significantly in the meaning given to terms like 'observation' or 'planning', while theoretical distinctions between stages are not very clear even when much careful thought has been given to them, e.g. between the *stages* listed by the APU or by Feuerstein.⁵ As a result, many people now see that we are evaluating even when we clarify a brief or make a plan, not merely evaluating at the end. All the different 'stages' are really going on all the time, and we can understand this if we accept Changeux' physiological description of an ability to overlap and compare concepts and percepts, and to make new concepts from the overlap. We must wonder whether pupils who are already using this brain function efficiently are always helped if we force them into any fixed idea of stages.

When teachers assess, they also find it difficult to decide what parts of a pupil's behaviour should earn the marks allocated to 'observing' or 'planning'. Does observing include making inferences involving syllabus content? Does planning include last minute coping with the unexpected, some of which ought perhaps to have been anticipated? Does evaluation include the earlier evaluations mentioned above? Examination Boards and schemes sometimes leave teachers free to make and weight their own very varied marking schemes, based on their own idea of 'process skills'. Other Boards lay down detailed subdivisions and rules, but these still vary between different Boards and examinations.

Teaching Difficulties

Teachers also find it difficult to see exactly what they are doing when they 'teach planning' or 'teach observing'. In the latter case they are often merely developing interest in a particular piece of subject matter, thus promoting careful observation. This is not,

however, the same as teaching a skill which pupils can transfer to other areas. To teach planning, some say they merely give pupils the experience of planning, and help them when stuck. Others let pupils 'absorb' the ideas, which are 'caught, not taught', but this may be a euphemism for allowing trial and error with a dash of 'sit by Nellie'. These teachers often cannot explain exactly what they are teaching, and though we all find ourselves in this situation sometimes, most of us would like *some* clear aims, to help pupils.

Tactics and Strategies as Being More Helpful

The idea of teaching tactics and strategies seems to be more helpful in many respects than 'process skills'. We take tactics and strategies to be general, transferrable and useful ways of approaching specific types of problem or parts of problems. They are not innate skills, but can be learnt and taught. Children may invent tactics for themselves, e.g. for getting round mother, and will also have many tactics instilled at home, like 'Look before you leap'. Other tactics can be taught at school, e.g. clarifying numerical results by graphing; scheduling the stages of a job with a flowchart; helping mental processes by making sketches; dealing with panic by taking a rest and trying a new way. Teachers can explain a tactic with stories, experiences and examples, and set tasks which require their use. Pupils can discuss other situations where the tactic might be used, e.g. in everyday life, and remind each other when a useful tactic has been forgotten. Teachers know what they are doing when they teach tactics and feel there is great value in tactics which can be transferred to other areas and everyday life. They can also feel more comfortable about assessing. For example, as long as other aspects such as concepts and interests are not impeding success, teachers can usually judge on a three point scale whether a pupil has a secure grasp of the tactic, a partial grasp that allows coping 'with help', or no real grasp at all. Self assessment and negotiated assessment can sometimes make this easier.

Strategies differ from tactics only in covering the mode of attack on a whole problem, not just part of it.

However, tactics often do not fit neatly into one single 'process' stage. Checking, for example can be done at any stage, and use of criteria occurs when clarifying a brief and when evaluating, but also at other stages.

Tactics often involve grasping new concepts such as the concept of a flowchart, of reliability or of pilot tests. They also involve skill: pupils can be more or less skilled in their use, though success will depend also on other concepts, innate abilities, attitudes and interests. Different people may also value a given tactic differently: attitude and affect can be involved.

I believe we have all been teaching tactics in school, but without necessarily listing them all in schemes of work or discussing what we are doing, and without always distinguishing between clear, teachable tactics and non-teachable, less clear 'processes'. Some standard approaches like the use of graphs can be called tactics. We should perhaps exchange ideas about what tactics different pupils need, look for new tactics worth teaching, discuss our teaching methods and become more conscious of our aims. Teachers collectively have this knowledge but it needs collating and disseminating.

Finding New Tactics Worth Teaching

Worthwhile tactics can often be identified by looking at the errors made by groups of pupils when carrying out tasks, and Feuerstein used this approach. If experienced teachers discuss their ideas of why certain pupils went wrong, they can often suggest a tactic that might help. Sometimes, however, we fail to detect a basic 'thinking' tactic in the confusion of practical actions and effects, especially if it overlaps several 'stages' or processes, as we understand them at the time.

Some published marking schemes with graded assessment objectives also contain helpful ideas for tactics, based on the experience of teachers. Sometimes, however, these are intermingled with content-loaded 'process skills', which are very different from transferrable, content-free tactics. For example, to ask for 'detailed' evaluation or 'significant' observation may really mean asking pupils to know certain science and technology concepts

which the examiners find significant or abstruse.

What Happens to Process?

If we consider 'process' to be roughly equivalent to 'problem solving ability' or 'thinking', and to be a complex innate ability, difficult to analyse, it is nevertheless important that pupils exercise it constantly. The demand for 'process' becomes therefore a demand that teachers provide *opportunities for interesting mental activities, especially activities that will help the learning and use of new concepts and tactics.*

Providing these opportunities is not difficult when pupils plan and make in technology, as long as we go beyond mere 'recipes'. It has however not been so easy in science, or in the science part of technology lessons, because these so readily become occasions for mere telling and regurgitating. We need banks of suggestions for suitable practical and thinking activities. How do we find them? How do we think them up? How do we check that we have looked at every likely avenue? Sometimes we can think up new ideas if we look at all the available lists of 'process skills' or assessment objectives, or all the *types* of activity listed by curriculum developers such as the Secondary Science Curriculum Review. Primary schools may prefer to look for just three types of activity: investigations, production work and social conferring.

'Process skills' therefore can be regarded in a new light, as being divided into two aspects. These are the *tactics we can teach* and the *provision of activities*, and we can classify these activities any way that helps us best, e.g. into those emphasising our own ideas of observing planning, etc., or into simulations, role play, surveys, etc.

The Difficulty of Making a Change

Even if the theoretical arguments for making a change are convincing, teachers cannot overturn their ideas while they are at the same time trying to master the particular marking scheme of their own Board or school. Gradual change is nevertheless possible at the pace and to the extent we wish. For example, if we find some tactics already listed within our marking schemes, these can be taught explicitly, as described above. Or we can teach any tactics we

think helpful to our pupils and modify our marking schemes to the extent that we are allowed or can request. The most acceptable tactics to start with will perhaps be ones which fit into a 'process skill' on the list teachers are currently using, because these can be taught as part of that 'process skill' without upset. For example, coping with panic may fit into the 'realising' stage; using standard checklists, and imagining it all the way through, may fit into the planning stage. On the other hand, using criteria could belong to clarifying the brief, planning or evaluation. Pilot trials and tactics for collecting information from libraries may fit into the earliest stages before any solution has arrived, or they may come later. Then if the current grouping of assessment objectives proves unhelpful that too can be reorganised. Many such changes in assessment objectives are already under discussion, in any case, and tactics could be included. It is possible that new ideas or discussion can be sparked by looking at a list produced by someone else from a different area, for such a list will inevitably contain surprises. My own current list is long and includes many low level tactics which can sometimes pass unnoticed. If anyone would like my list I can send it for £1, post free in the UK. My criteria for including any tactic in the list may also be different from those of other readers, so they are included.

References

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