CONTENT IN THE SCIENCE CURRICULUM

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With the explosion of knowledge in science, questions arise as to who should select facts, concepts, and generalisations for students to attain. The balance of this paper will explore diverse schools of thought emphasising subject matter to be emphasised in the science curriculum.

The Structure of Knowledge

A valid means in selecting subject matter for student acquirement might emphasise academicians in the science disciplines choosing vital content. Thus, knowledgeable astronomers, biologists, botanists, geologists, zoologists, chemists and physicists need to agree upon key generalisations. The chosen conclusions might then be emphasised as objectives in the science curriculum. Relevant learning activities guide students in attaining the vital ends, after which evaluation techniques need emphasis to ascertain learner progress.

In emphasising structural content, King and Brownell quote the following pertaining to the thinking of Jerome Bruner.

Bruner hypothesises that learning structures of disciplines:

Is learning how things are related.

Makes a subject more comprehensible.

Slows forgetting.

Permits reconstruction of detail through patterns.

Is the main road to transfer of training.

Narrows the gap between advanced and elementary knowledge.

Leads to intellectual excitement.

Supplies bases for and enhances intuitive thinking.

Is the bridge to simplicity. (Therefore structures can be taught to anybody in some honest form).

Provides a path for progression of learning in each discipline.

Bruner further advocated that students learn to utilise methods of inquiry as emphasised by academicians in their academic areas of speciality. Thus, in the science curriculum, inductive methods of acquiring content are recommended. Laboratory approaches need to be a definite part of each science unit.

Why might the structure of knowledge approach be relevant to stress?

1. Subject matter specialists have selected vital content for student attainment. Trivia may then be minimised in ongoing units of study.
2. By utilising methods of study advocated by scientists in their respective disciplines, learners may well glean worthwhile content as

well as use valid approaches in attaining major generalisations.

3. Science teachers secure valuable help in developing the curriculum by incorporating content advocated by scientists.
4. Relevant objectives may be chosen by teachers when incorporating structural ideas as well as methods of inquiry used by academicians in the world of science.
5. Science teachers can select a variety of activities to achieve the chosen objectives. These include laboratory methods, excursions, slides, films, filmstrips, textbooks, workbooks, supplementary reading materials, transparencies, objects, models illustrations, and drawings. The science teacher needs to be a creative being in guiding students to attain worthwhile objectives.

Reinforcement Theory

If students are successful in achievement, reinforcement is then in evidence. To achieve continuously, students need to acquire sequential small bits of vital subject matter. Attempting to master a larger amount of content at a specific time is not advocated. Thus, in programmed texts or using Computer Assisted Instruction (CAI), the involved learner reads several sentences, responds to a completion item, then checks his/her response with that given by the programmer. If the response was correct, reinforcement is in evidence. If incorrect, the student knows the correct answer and is also ready for the next item. A similar/same approach in programmed learning may be used again and again—read, respond, and check.

Woolfolk and Nicholich wrote the following:

The linear approach is often referred to as Skinnerian programming, because Skinner was its founder and prime advocate. One of its most notable features is that students must actively create an answer, not just select one from a multiple-choice format. They cover the correct response until they are ready to check their own answer. In linear programmes, students move through a fixed sequence of frames designed to lead them from one concept to the next with as few errors as possible. If students do make a wrong response, they learn of their error immediately, see the correct answer, and move on to the next frame.

Linear programmers tend to believe that students should make errors on no more that 5-10 per cent of the frames. In order to keep errors at this low level, the developers of the programmes pilot-test the frames, identifying those frames that give students the most trouble. These error-causing frames are then improved or broken down into smaller steps to make success more likely.

Why is reinforcement theory important to emphasise?

1. Learners can be successful in almost every sequential step in learning.
2. A small bit of context is learned before a student checks his/her response. Thus, misunderstanding of subject matter is minimised. A check is made of a learner's response before moving on to the next sequential item.
3. The programmer, a specialist in subject matter content, sequences content for learners.

Relevant ideas are then in the offing for student learning.

4. Appropriate order (sequence) in learning optimises student achievement.
5. By building on specifics in knowledge, a learner may ultimately achieve major generalisation and main ideas.

Humanism and the Science Curriculum

Humanists also have much to contribute in developing the science curriculum. A devout humanist believes that learners should have considerable input in ongoing lessons and units.

Teacher-pupil planning may be utilised to select objectives, learning activities, and evaluation procedures. Students should then perceive increased purpose in learning. They are involved in determining what is to be learned, the means of learning, as well as appraising progress.

A second approach in emphasising humanism in the science curriculum may involve the use of learning centres. The following centres are given as examples: audio-visual aids; models and objects; experimentation and demonstration; problem solving; excursions; reading and writing; as well as a creative endeavours centre. Tasks may be written on a card with one task card per centre. Learners can select which sequential tasks to pursue and which to omit. Continuous progress on the part of each student is vital.

A third method might emphasise a contract system. Each student with teacher guidance develops a contract. The interests and purposes of the involved learner are involved in developing the contract. Once agreed upon, the learner and the instructor sign the agreement with the due date of requirements attached. The goals of learning are decided upon cooperatively by the student and the involved teacher.

A fourth method of stressing the psychology of humanism emphasises the teacher writing and discussing listed topics for students to pursue. The topics listed on the chalkboard reflect subject matter that the students may learn. For example, if ten questions are listed on the chalkboard, chosen by the teacher, the student may complete any five as a minimum requirement.

Pertaining to humanistic education, Combs wrote:

There are two frames of reference for looking at human behaviour available to us. One of these is the external or objective approach familiar to most of us as the traditional view of American psychology. Seen from this frame of reference behaviour is described from the point of view of the outside observer, someone looking on at the process. Its classic expression is to be found in the various forms of stimulus-response psychology which seeks the explanation of behaviour in the observable forces exerted upon the individual. The perceptual psychologist takes a different view. He seeks to understand the behaviour of people from the point of view of the behaviour himself. His is a phenomenological understanding of human behaviour, emphasising the meaning of events to the person.

Perceptual psychology is basically a field theory and its primary principle is this: All behaviour, without exception, is a function of the behaviour's

perceptual field at the instant of behaving. I am using the term perceptual here in its broadest sense as practically synonymous with meaning. Thus, the individual's behaviour is seen as the direct consequence, not of the fact or stimulus with which he is confronted, but the meaning of events in his peculiar economy.

Inherent in humanism are the following tenets:

1. students need to become proficient in decision-making skills.
2. self-fulfilment on the part of the involved student is significant to emphasise in personally choosing what to learn.
3. learners feel increasingly secure and develop feelings of belonging in a humane learning environment.
4. each student perceives significance in learning. The teacher cannot determine relevance for learners.
5. sequence in learning resides within the student, not with teacher determined content for students acquisition.

Conclusion

There are selected philosophies of education which might well provide guidance in developing the science curriculum. The following are recommendable philosophies to consider, adopt, or modify:

1. structural ideas identified by academicians which students may achieve inductively on their own unique levels of understanding.
2. reinforcement theory with sequential programmed steps of subject matter to be acquired by students. Success in learning is inherent, thus providing for reinforcing (rewarding) of desired achievement.
3. humanism which advocates learners choosing sequential content within a flexible structure. Students input are involved in selecting objectives, learning activities and evaluation procedures.

Teachers and supervisors need to study and analyse diverse philosophies with the intent of selecting criteria which guide each student to achieve optimally in the science curriculum.

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