EDUCATION GROUP DISCUSSION

Modern Teaching Aids and Methods with Special Reference to Use at Sea

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In this paper, the authors look at teaching as a matter of communication; recognizing that the trainee at sea finds himself in an unique situation, they go on to consider ways in which communication from a teacher or from a teaching device can be initiated and how it can be modified by aids in order to increase its effectiveness.

They go on to discuss aids which an officer aboard ship might employ in order to improve any instruction that he might give to apprentices under his care—the magnetic board and various types of projector.

Finally, it is recognized that there may well be a place aboard ship for devices that teach in their own right; programmed learning is discussed in both its theoretical and practical aspects; teaching machines of many types are investigated and the making of teaching-films is discussed.

KEEPING IN TOUCH

Learning is a solitary process that goes on under our skins, but teaching involves at least two people and it can only happen as long as they keep in touch with one another. This "keeping in touch" is such a commonplace activity in teaching that we can be forgiven for ignoring it and for seeking out difficulties to solve in the technicalities of the equipment we use or in the complexities of organization. Yet this is the fundamental and all-embracing difficulty of teaching. The apparatus, the organization, the buildings—the whole fabric of our educational and training world is built around the need for teacher and learner to keep in touch with one another.

At last, economic and social pressures are forcing us to find out more about it. In industry and commerce, in government and the Services, in recreation and education, more and more is being written, said and thought about how people do keep in touch under the general name of "communication". At root, it attempts to answer the question of how a particular group of ideas in the mind of person A—a teacher for example—can most easily and quickly, become a sufficiently similar group of ideas in the mind of person B—his student.

The simplest sequence is shown in Fig. 1. The teacher translates his ideas into, say, words—an easy enough exercise if his idea is, "Two sixpences have the same monetary value as one shilling", but difficult if the idea is a response to the opening phrase of Mahler's Second Symphony. These words must now travel, without too much distortion, to the ears of the learner who must hear them and translate them back into something like their original form. From these studies, two outstanding precepts emerge:

1) The teacher should *find out* whether the idea which the learner constructs is an adequate replica of his own.
2) He should use as many different ways of transmitting the idea as he reasonably can.

To satisfy the first need, he could ask questions, set exercises or start a discussion on the subject, and for the second he could express his idea in words, in writing and by a gesture—possibly simultaneously.

The communications experts call these two basic require-

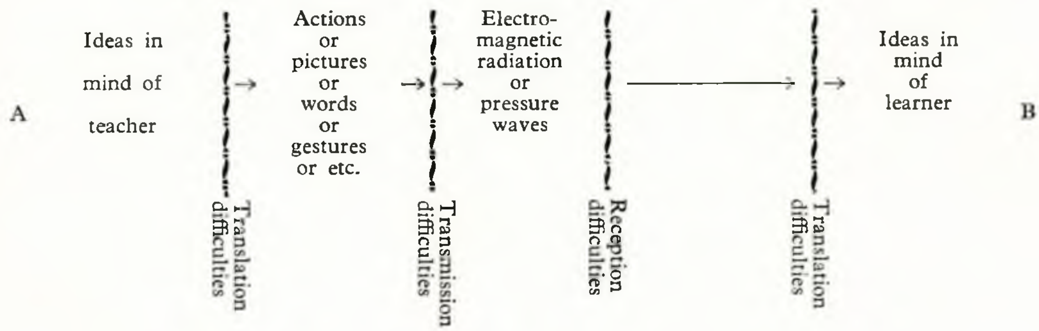

FIG. 1—*Simplest sequence of transmission of ideas from teacher to learner*

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ments of good communication, *feed-back* and *redundant channels;* the educationalist sees them more often than not as "question and answer" and teaching aids. These alone do not make teaching efficient since they must fit into some sort of framework, or lesson. Consequently, teaching equipment and teaching methods are complementary.

Teaching Methods

The professional education of seafarers, to whatever department they may belong, is bedevilled by a traditional prejudice against protracted, full-time courses ashore. An honourable exception has been the alternative entry scheme for marine engineers and it is heartening to see that deck apprentices will soon have similar opportunities. These courses, however, cater only for a minority and "sitting next to Nellie" remains the principal method by which professional "expertise" is communicated to our young trainees. We would be closing our eyes to reality if we were to prophecy an early end to this practice as the industry has yet to be convinced of the value of full-time or sandwich-course training and, in this frame of mind, it is unlikely to offer an officer under training more substantial financial incentive to improve his technical qualifications.

Learning at sea, then, forms an important part of the professional training of both engineer and navigator and it is likely to continue so to do even under any improved system of nautical education. The young apprentice must lean heavily upon text books (and, for navigators at least, many of the standard works are obsolescent), upon correspondence courses (and the inherent delays in overseas mails rob these of much of their value) and upon the qualified engineering and navigating officers who find themselves in the position of Nellie.

The organization of "on-the-job-training" varies tremendously from one company to another. In a few seagoing cadetships, full-time lecturers are employed and it is to the credit of the engineering department that, in their case, these men often have pedagogical as well as technical qualifications. Cadetships apart, some companies lay a responsibility upon a particular officer to actively organize the instruction of apprentices, but it is probably fair to say that in the majority of ships the initiative has to come from the apprentice himself, that he will approach an understanding and knowledgeable officer of his own department for the help that he needs.

Sympathy and wisdom, however, will not ensure successful communication between such an officer and his apprentice. Some slight knowledge of teaching aids on the part of the former will go a long way towards removing the "noise" that is likely to come between teacher and taught.

THE POTENTIALITIES OF VISUAL AIDS

Illustrations are commonly used to show what things look like. A two-minute sound film, showing an engine room layout, for example, may replace a much longer verbal description. Relationships expressed in graphical form can efficiently crystallize a welter of numerical detail which, at best, should be studied from a duplicated hand-out.

Some design problems, work-study examples and ergonomic principles, for example, can often be reduced to a series of superimposed diagrams which can be projected onto a screen. Such illustrations are efficient solutions to the technical problem of communication and commend themselves automatically to technical people.

Visual aids, however, can also make secondary and subtle contributions to the efficiency of the learning to which they are directed. Well chosen and properly handled, they are seen as evidence of a teacher's concern for his students who, in their turn, are more ready to co-operate with him. With a little experience, teachers can "feel" such acceptance and meet it; as a consequence the group and the teacher become more identified with one another in the same way as actors with their audiences; the situation becomes more dynamic and more work-centred.

If aids are used to serve this end, in addition to being appropriate, they should be technically good, aesthetically reasonable and competently handled. A descent into darkness to see a single untidy slide of doubtful value can appear pretentious or pointless whereas a visual that provides valuable information in a concise and striking fashion appears both complementary to the verbal description and complimentary to the student.

Suitable Aids for Teaching Marine Engineering

Magnetic Boards

These consist of sheets of iron or tin plate—often painted so that they will serve as chalk boards, on which shapes, backed with disc magnets, will adhere. They are particularly useful for showing the effect of movements—the cycle of a mechanism, flow diagrams, arrangements of parts, or stowage principles. Although they can be used to present an effect in a striking fashion they are best employed to assist sustained observation.

The magnetic board may consist of a sheet of tinplate, the corners of which have been rounded, fitted with a cord from which it can hang; it may be made like a shallow hinged box to contain the pieces or it may be made into a permanent illustration (see Fig. 2). It may, equally, consist of the metal

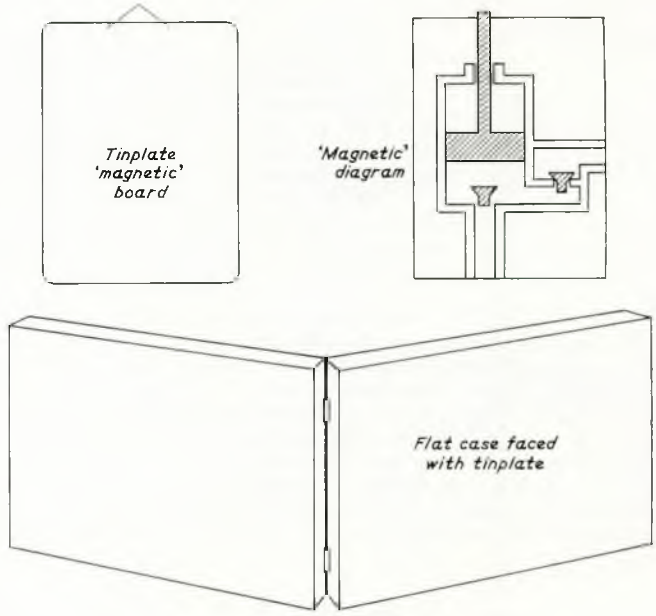

FIG. 2—*Magnetic boards*

hull of a ship. Disc magnets can be fitted to the back of hardboard, wood or cardboard shapes with an impact adhesive or with Sellotape.

Slides and Film Strips

Although the $3\frac{1}{4}$-in. square lantern slide is still common it is obsolescent. The 2-in. square transparency is excellent for teaching or private study. For the latter purpose, tape recordings used with sets of slides have proved of great value in a number of fields. Battery-operated tape recorders which take tapes already loaded in plastic casettes are probably most suitable for use aboard ship. The tapes and slides can be prepared as packaged lessons, the learner being told when to change his slide. (Automatic slide synchronizing devices are available but they are in the nature of luxuries). If pictures are needed during only part of the verbal description, the rest of the slide frames should contain written headings; it is not wise to tell the student to switch off the projector.

For this work, projectors built into back projection arrangements are suitable. The screen need be no more than a foot wide and, indeed, a good slide viewer will suffice. With such "packaged lessons" the learner can work at his own pace and should be encouraged to report any difficulties he finds so that the lesson can be improved for the next trip.

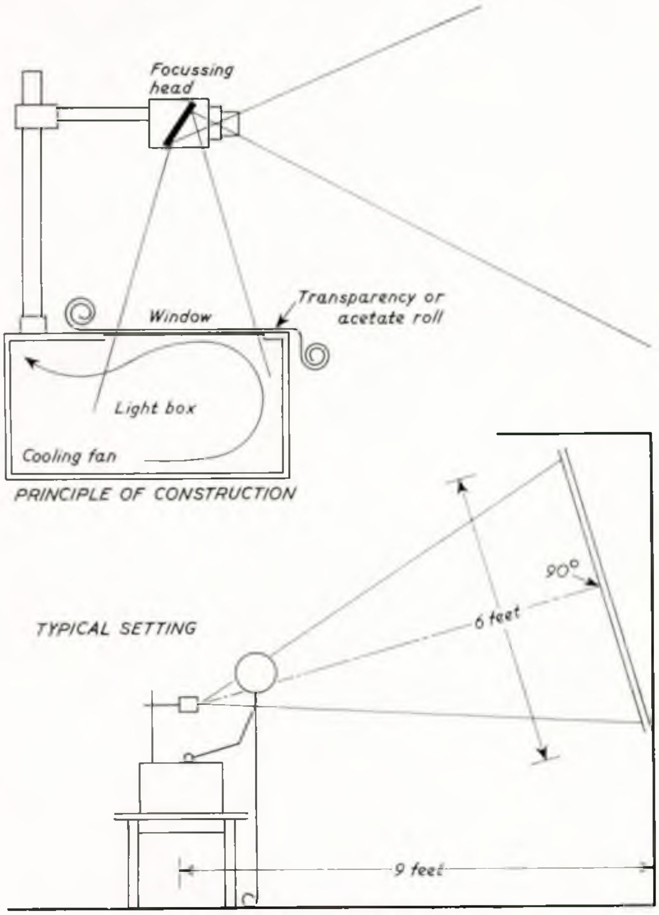

FIG. 3—*Overhead projector*

Film strips serve the same purpose as sets of slides. They are available in very large numbers on a wide range of subjects but each follows a fixed sequence which may not be best for every student. They can, however, be cut into separate frames and mounted in holders to fit 2-in. square slide mounts.

The Overhead Projector

This consists of a light box with a large glass window (usually ten inches square) in its lid (see Fig. 3).

Light passing upwards through this window can be focussed on a screen, where it makes a picture of the order of some five feet square. Room lights need not be dimmed.

It can be used as a chalkboard substitute and, indeed, for this purpose most instruments are equipped with a roll of acetate film. This is 10-in. wide and 50ft. long; it unrolls across the top of the window, on which it lies flat, to another roller on the opposite side of the box. As the teacher writes on the film with a wax based pencil, so the image of his writing appears on the screen. If he turns one of the rollers, the image moves across the screen and more writing surface is brought into position above the window.

Transparent squares of acetate film mounted in cardboard frames are, to the overhead projector, what the lantern slide is to the slide projector. The basic difference between these two forms of transparency stems from their considerable difference in size, and the consequent greater ease with which those for the overhead projector can be made.

Being so large, slides can be drawn or traced by hand either with suitable pencils or with pen, using transparent coloured inks. They are fixed into mounts with adhesive masking tape. A wide range of slide-making materials is available including sheets of adhesive letters, adhesive shading and coloured foil. Transparencies can also be prepared by photocopying methods, in which case they are reproduced the same size as the original from which they are made. Dyeline photocopying produces images from black originals and these are particularly suitable for presentation as a series of overlays.

Portable overhead projectors which fold up to form a small closed box fitted with a handle are available. These can be used with good effect for tutorial work in even a small cabin. The tutor and apprentice can sit facing one another in comfortable chairs with the projector on a low table beside them. Illustrations or examples can be projected onto a wall—it need not be white—without any disturbance to either (see Fig. 4).

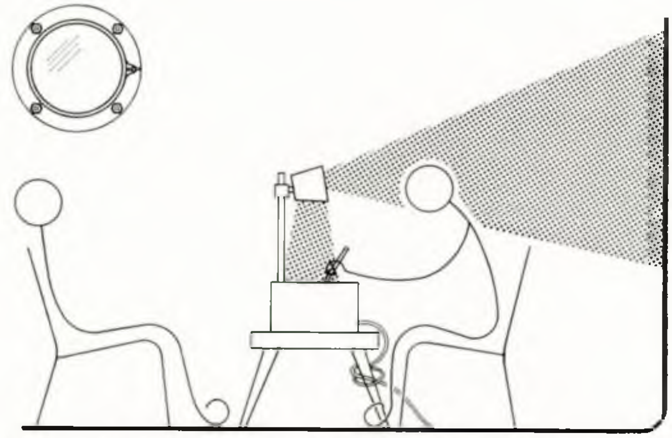

FIG. 4—*An overhead projector being used for a tutorial session*

Teaching Machines

This, perhaps, is a misnomer, for the machine teaches nothing; it is merely a convenient mechanical device for presenting to a student a series of lessons which are constructed in accordance with recognized psychological principles—programmed texts, as they are called. It would be wrong to think that programmed instruction is entirely a new technique—every teacher since Socrates has attempted to present information to his students in small, logical steps, trying always to work from the known to the unknown and trying always to praise and encourage. This, however, was always in a face-to-face situation; the novelty of programmed texts lies in the fact that learners can use this technique for individual, un-aided study.

Reinforcement Theory: Until fairly recently educators have believed that long periods of private study and the successful completion of correspondence courses was largely a matter of morality: some folk had the will-power and self-discipline and others had not. They are now beginning to question this view and find the more subtle mainsprings which motivate people to persist in study when they are not timetabled by an overseer of one kind or another.

There is now a body of research which shows that people persist in learning when they believe in the likelihood of success in particular ways. This area of conclusions can be lumped together as the reinforcement theory of learning. People learn by observing the consequences of actions and, as a result, modify their responses to stimuli. This is learning, whether it be the memorizing of facts, the acquisition of skills or the structuring of insights and concepts. Those consequences of actions which enhance the prospect of the action being repeated are called reinforcements. Prompt reinforcements and frequent reinforcements increase the prospect of an action being repeated, whereas no reinforcement or delay inhibits repetition. By exploiting differential reinforcement, the amount and kind of learning which a student acquires can be controlled. In this case desired learning will be reinforced whilst activity which is not directed to the end in view will be inhibited by lack of reinforcement. Since reinforcement is regarded by the learner as success, it provides its own motivation, making the prospect of persistence greater.

Although, on closer inspection, this theory seems to state the obvious, knowledge of the process is rarely exploited to the full in conventional learning situations except where adults with time on their hands are teaching young babies whom they love. Here the adult is prepared to praise or reward immediately after the accomplishment of each successful learning step and each correct repetition, however slight the progress may be: nature endows him with extraordinary reserves of patience and concentration. This is the background to the tremendous rate at which babies learn despite the relative immaturity of their brains. Learning a language in a year is an impressive achievement. But this kind of teaching would be extremely wasteful of manpower and makes impossible demands on a human teacher's patience and persistence.

Protagonists of the reinforcement theory hold that, within the limits set by a learner's physical and mental capabilities, the pace of learning could be considerably accelerated as a consequence of the relentless application of differential reinforcement. It is upon this foundation of thought that such teaching devices as teaching machines and language laboratories have been developed — and, of course — certain techniques of advertising.

Private Study: A learner who is following a correspondence course or who is studying privately must continually make certain major tactical decisions: he must choose a method of studying and he must decide when each learning phase is completed to a sufficient degree of permanence. But just as every physical system takes up a position of least potential energy, so every learner follows the course of action which seems to take him towards the desired goal with least expenditure of unrewarding effort and, of course, learning is the outcome of effort. Consequently, the ability to cope with private study is a matter of motivation rather than morality. Students who are detached from the main social sources of motivation—school, home and friends—generally gain far less from the absence of distraction than they lose from the absence of motivation. This state of affairs could justify the exploitation of teaching machines at sea.

Programmed Instruction: A teaching programme is a course of instruction in the form of a sequence of information presented in such a way that, as the learner responds to each step, he knows immediately whether he is successful or not. Teaching machines are devices designed to present such programmes in a way that will leave the learner free to concentrate on the subject; the programme relieves him of tactical decision-making and the machine takes away the slight difficulty of mechanical manipulation. Only one learner can operate a teaching machine at a time, and this he does at a pace which he matches to his learning speed. Programmes may also be displayed in book form or in the form of sheets or strips of paper fitted onto specially designed (or home-made) boards. The heart of any teaching machine is its programme.

There are two main groups of programmes: the so-called linear programme and the branching programme which express, respectively, the theories of the experimental psychologists on the one hand and the differential school on the other. Linear programmes stem from the researches of Professor B. F. Skinner of Harvard University. They consist of a gradually graded series of items each leading to a "question" which the student must answer before proceeding. The items are so graded that no step is ever too difficult for the student to follow and the "questions" are of such a kind that they reinforce only responses which are compatible with the goal to be achieved. If the programme is appropriate, the student will respond correctly to at least 95 per cent of the "questions".

The "question" consists, as a rule, of a missing word which must be correctly written by the learner, a drawing which must be completed or a calculation which must be solved. This "writing in" is called a constructed response, and Skinner holds that constructed responses elicit deeper thinking and greater motivation than mechanical responses which characterize the branching programmes. The kind of progress which such programmes evoke may be gathered from the example given in Fig. 5.

Frame	Stimulus	Response
1	Any device which drives current around a circuit is called an electricity generator. A dry battery and a running dynamo are electricity.........	generators
2	An electromotive force will drive current around a circuit and consequently there is an .... in an electricity generator.	electromotive force
3	An .... in a dry battery drives current around a circuit	electromotive force
4	When a dynamo is running it generates an....................	electromotive force
5	Chemical energy in a battery is used up in circulating current around a circuit. The electromotive force (e.m.f.) is obtained at the expense of chemical...........	energy
6	In a dynamo, the e.m.f. is obtained at the expense of mechanical...........	energy

FIG. 5—*Example of linear programme*

This sequence is aiming towards a clearly defined and limited objective—an understanding of the concept of e.m.f. and the definition of an e.m.f. of one volt as a joule per coulomb. It has a certain group of students in mind who have a knowledge of work and energy and the basic M.K.S. units in mechanics. Notice that the responses which are constructed are keys to understanding, that they are repeated, that each step overlaps its neighbours and that there are prompts to the correct response—the word *an*, for example, must be followed by a vowel and the space available after it invites a long word.

A most important characteristic of this type of programme is that *each response is an integral part of the process of learning.*

The protagonists of the differential school of psychology attach less value to the act of construction than do the experimental psychologists. As a result of the researches of Dr. Norman Crowder, they feel that programmes should be designed to suit a variety of learning abilities so that they can be adapted by the learner as he uses them. With these programmes, the student learns from the stimuli: the responses are designed to control the next step which should be taken in view of the progress implicit in the response. The learner is therefore presented with a number of ideas in each frame and he is then required to select one right statement or course of action from a number of alternatives. If he is right he moves on to the next stage which leads directly to the goal. If he is wrong, he is directed to a sub-programme which corrects the kind of error of which the selected response is an example. He then returns to the frame which he misunderstood and tries it again. This arrangement is called a branching programme, an example of which is given in Fig. 6.

The distinction between these programmes may be represented as in Fig. 7. Fig. 8 shows a more complex type of branching programme with three sub-routes suitable for slower learners. Programmes which exploit sub-routes fully have been

Frame	Stimulus	Response
1	A dry battery, and a dynamo whilst it is running, are electric generators. Both will drive current around a circuit and, whilst current is flowing, energy conversion takes place in the generator. In a dry battery chemical energy is being changed into electrical energy whilst, in a dynamo, mechanical energy is used up. The measure of the electrical driving force in a generator is called its electromotive force, or e.m.f. The electromotive force in a battery is derived from: (a) the electric current which is circulating around the circuit (b) the chemicals from which the battery is made (c) another generator such as a dynamo	 Press button A Press button B Press button C

Pressing button A reveals the following frame:

1 (a)	The current which circulates around a circuit is *caused by* the electromotive force. If the battery were disconnected and the battery leads then joined together no current would flow because there is nothing in the circuit to drive it. Press the RETURN button and read frame 1 again	Press RETURN

Pressing button B reveals the following frame:

2	Your answer is correct. The electromotive force of a battery can drive a small current around the circuit for a long time before the battery is "used up" but it becomes exhausted much sooner if the current is a large one. If an electromotive force drives 12 coulombs around a circuit at a steady rate in 6 seconds, the current which flows is $\frac{12 \text{ coulombs}}{6 \text{ seconds}} = 2$ C/s = 2 amperes (2A) If a current of 5A flows for 10 minutes, the total charge moved by the electromotive force is: (a) 3,000 coulombs (b) 120 coulombs (c) 50 coulombs	 Press button A Press button B Press button C

Pressing button C reveals the following frame:

1 (c)	A dry battery is an electric generator. In an electric torch it will drive current through a lamp and light it. No other generator is needed. This electric current is circulated by the battery; if the battery is removed and its leads joined together no current will flow. Press the RETURN button and read frame 1 again	Press RETURN

FIG. 6—*Example of branching programme*

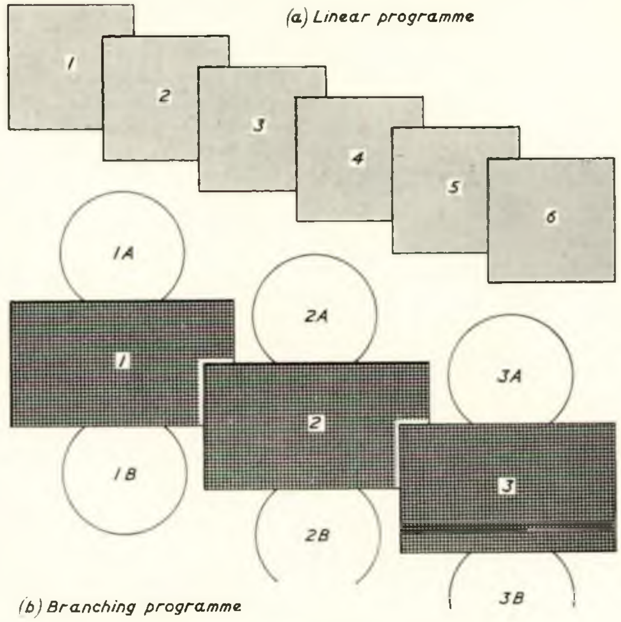

FIG. 7—*The structures of teaching programmes*

investigated by researchers at Sheffield University under Professor H. Kay and are called Sheffield programmes.

Programme Writing: Before beginning to write a programme, certain decisions must be made, of which the following three are basic.

1) The aim of the programme must be quite precisely stated in words and a performance test prepared to indicate whether the programme has been successful or not. This should provide a clearly defined goal.
2) The population for whom the programme is intended must be specified. It may be important to know, at least their age range, intelligence quotient, experience and present occupation, educational attainment and nationality.
3) The present knowledge of the intended students within the subject must be known and specified.

The next step is to abstract the concepts to be taught, to arrange them in a sequence and then to check the coherence of that sequence. In teaching, the actual coherence of a sequence is of less importance, since minor adjustments can be made in the light of discussions which arise in class, but once a programme is made, it is inflexible even if there are sub-routes. There can be no saying, "Oh, I should have explained so and so . . ." or "Leave that for now and it will become clear after tomorrow". There are special techniques for testing the flow of a programme and these can be found in such books as *Programmed Learning in Perspective* by Thomas, Davies, Openshaw and Bird.

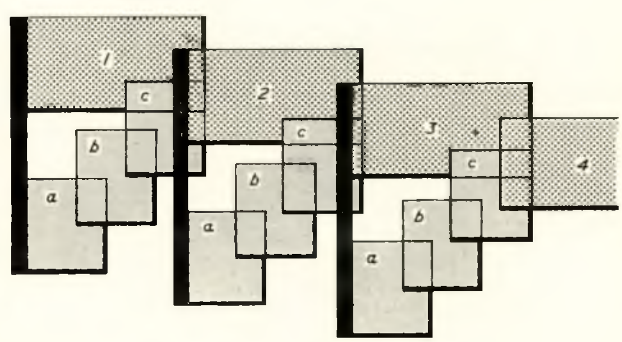

FIG. 8—*Sub-routed programme*

Although the procedure of programming is becoming something of a technology in its own right, experienced teachers should not be deterred from trying their hands at it: many of the methods used by professional programmers merely help them to avoid pitfalls which teachers of experience know very well. The jargon includes such terms as lead-in frames, rote-review frames, fading frames, thematic prompts and so on, and although the terms may be strange the teacher will recognize their structure and function quite readily. Nevertheless, a study of programme writing—preferably a course—will be repaid by time saved in later revision.

If a programme in a particular field is needed and money is not to play its customary stultifying role, a scheme of work can be prepared and sent to a professional organization for preparation. Programmes of courses in popular demand are available commercially.

Evaluation of Programmes: Programme writing proceeds by stages, each ending in an evaluation of that stage. When the first crude draft of a programme has been written it should be tested for gross errors of judgement. This can be done by going through it verbally with the type of person for whom it is intended and asking questions, or by preparing two versions on foolscap and sitting with a couple of students as they work through them. This shows up frames that are out of place, badly worded, too easy or too difficult and so on. In the light of the results of this preliminary trial, a programme is produced in its final form—on film strip or cards, etc.—and then tried out on a sample of, say, fifty students. From this, it is generally useful to prepare a matrix of errors such as the one shown in Fig. 9.

Frame	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Student																				
1						x					x						x	x		
2						x				x	x	x		x	x		x	x		
3																	x			
4						x														

etc.

x means that the students gave a wrong response

FIG. 9—*Matrix of errors*

In the example, it seems as though student No. 2 lacks either background or ability and the actual cause of his difficulties should be found. Frame 6 seems unsatisfactory since it is throwing up a number of errors. If frames 17 and 18 are test frames for the preceding section, it seems as though it needs rewriting.

Some of the results obtained by external evaluation will be considered later, but even if a programme is produced by professionals, users will often be able to help enormously by making these internal evaluations particularly during the preliminary stages.

PRESENTATION OF PROGRAMMED MATERIAL

It must be emphasized that "programming" is based upon some of the psychological theories of learning. It is simply a way of presenting knowledge to a student. Just as any teacher has the choice between giving facts to his class by means of verbal exposition or by writing words on the chalk-board, so programmed material can be presented to a student in two different ways—by book or by machine.

Programmed text books are available, containing either linear or branching programmes. The examples given earlier show the manner in which a linear programme may appear in a book, where each short piece of learning (or frame) is followed by an "open-ended" question, the answer to this appearing alongside the frame or below it. The student is instructed to read each frame whilst keeping the following frame (and, of course, the answer to the current question), covered with a piece of card. Having decided upon his own answer, the student then moves the piece of card away and checks his response against the printed answer.

There are many text books available on the market that embody linear programmes; a notable series is published by Methuen which is providing courses in mathematics and geography for secondary school children.

Branching programmes are also available in book form, though this type of programme has confronted authors and publishers with a more difficult problem. The reliance of the branching programme upon the "multiple-choice" question means that the student must make his selection from the possible responses offered without an opportunity for seeing in advance which is the correct one. Thus, with the question at the bottom of each page of material, each of the possible answers has to be discussed on a separate page. If the student makes the right response he will be directed to that page which proceeds with the next step of the subject-matter; if his choice should be incorrect, he is directed to another page where his particular mistake will be explained to him before he is asked to make another attempt at the original question. With every one correct response there are often four that are incorrect with the result that for every page of subject-matter there may be as many as five pages dealing with the answers to one question. To ensure that access to the answers is not obtained accidentally these "answer pages" are distributed at random throughout the book and it is from this feature that branching programmed text books have earned their common name of "scrambled text books". It follows also that such books are bulky and expensive and there is some evidence to suggest that they may be one of the less popular means of presenting programmed material.

Nevertheless, some of the best programmed text books have been produced in this form; the English Universities Press is presenting a comprehensive list of titles under the general title of Tutor Texts and already published are some dozen programmes ranging from the Elements of Bridge Playing to the Arithmetic of Computors.

It is probably safe to suggest that the best means of presentation of programmed material is by the "teaching machine". Linear programmes can be displayed in comparatively inexpensive machines; indeed many teachers are making such machines for themselves. This is possible since the programme demands only the presentation to a student of a series of frames whose order is both pre-determined and invariable. Thus the machine must provide some sort of

FIG. 10—*The Empirical Tutor*

"window", through which only one frame can be seen at a time, and a manual or mechanical device by which the student can replace the frame by the next one in the sequence. Such machines are simple and can be inexpensive; one example is the Programme Board which is designed especially so that a teacher may use it to present a programme of his own devising. This retails for less than two pounds. A rather more sophisticated linear machine is the Esatutor. This relies upon mechanical methods for frame-changing and costs about fifteen pounds.

Once again, the branching programmes make more demands upon machines as means have to be devised to display frames in almost any sequence according to the way in which a student progresses. One of the most interesting of these machines is the Empirical Tutor (see Fig. 10) which is capable, in fact, of presenting both linear and branching programmes. This machine is distinguished by the fact that ancillary equipment can be coupled to it in the shape of a slide-projector and a tape recorder. These two instruments are synchronized with the teaching machine so that the presentation of a particular frame of subject matter will coincide with the exhibition of

FIG. 11—*The Grundymaster—A typical "Linear" machine*

FIG. 12—*The Grundytutor*

a colour slide illustrating some principle or object that is described in the frame. Alternatively, or at the same time, the tape-recorder may be automatically switched on to give a spoken commentary upon the frame, or the slide, or upon both. This equipment markets at nearly five hundred pounds.

Perhaps more typical of branching teaching machines are the Grundytutor (see Fig. 12) and the Autotutor (see Fig. 13). Whilst these differ in some detail they both carry their programmes on 35 mm. film and the frames are projected internally on to a small screen at the front of the console. Frames can be changed by the student pressing a button and there is a button allocated to each of the answers to every multiple-choice question. Pressing a button simply drives the spools upon which the film is carried and according to which button is pressed, so the appropriate frame is selected for projection upon the screen. Both these machines retail at about two hundred and fifty pounds.

FIG. 13—*The Autotutor teaching machine*

Once again, it is worth mentioning that it should not be beyond an ingenious teacher to devise his own means of displaying a branching programme; one such that the authors have seen utilized is a Cardex type filing system with numbers replacing the usual letters of the alphabet. Starting at frame 1, the student reads his first page of material, reaching the first multiple-choice question at the end. According to which of the answers he selects, so he is directed to another numbered card where he finds the next frame of subject-matter or remedial teaching as the case may be. This, in a sense, is a type of scrambled text book but, since it eliminates the rather frustrating "page-turning", it might more properly be regarded as a manually operated teaching machine.

EXTERNAL EVALUATION OF PROGRAMMED LEARNING

The immediate origins of learning through programming lie in the United States and research in that country seems to indicate considerable potential for the method. Educationalists in this country have been interested in programmed learning only for some five years, but British research, notably in the universities of Sheffield and Aberdeen, is beginning to find similar results. However, it is not only in academic circles that such investigations are being made; one of the most intensive studies has been made by the Royal Navy.

Obviously the Services must be concerned with training; the Navy estimate that at any one time 20 per cent of their manpower is undergoing training. Any device that holds out the promise of reducing training time must be worthy of investigation and a reduction of learning time is one of the claims that is made for programmed instruction.

The standard method of evaluating the success of the programming technique is to assemble two or more classes of students each carefully matched for intelligence and ability. Each is tested to ascertain prior knowledge of the subject that is chosen and any students possessed of such knowledge are rejected. Assuming two such classes, one will then be taught the subject through the medium of a programme whilst the other will learn precisely the same subject matter from a "live" teacher using conventional teaching methods. At the end of the course, both classes are tested on what they have learned (the "post-test") and finally, some weeks later, both classes are given a "retention-test" to ascertain the extent of their forgetting.

The first experiment conducted by the Royal Navy endeavoured to assess not only the success of teaching machines compared with the criterion of conventional teaching, but also to compare the programmed text book with both of them. The research was carried out at H.M.S. *Raleigh* and three classes of junior entrants comprised the three experimental groups required. A commercially produced programme on trigonometry was available both for use in an Autotutor machine and as a scrambled text book. One class was assigned to the former, a second to the latter and the third to a qualified and experienced Instructor Officer, who was charged with the task of covering the same ground as the programmes; he had not, however, read the programmes himself, and it was left to this officer to teach the subject in whatever sequence he thought best.

In this experiment, the actual learning was spread out over a period of some two weeks at the end of which all three classes were given the same test, comprising seventy questions. Before giving any results for this test, it should be mentioned that, within the stipulated period, both the classes working on programmed instruction had completed their courses; the class learning from the Instructor Officer had completed only about seventy-five per cent of the syllabus.

In the post-test, results showed that there was no significant difference in the scores of the groups taught by machine and Instructor respectively, but the performance of those students who had learned from the scrambled text books was rather less effective than either of these. Thus it appeared clear that the teaching machine taught as well as the live instructor and that it completed the course of lessons in a considerably shorter period of time.

Results in the retention test, which was given to all three classes two weeks after the post-test, provided more evidence of the efficacy of the programmed learning. The two classes that had learned from programmes showed a percentage loss of marks of about three, whilst the class that had been taught by the instructor showed a percentage loss of four and a half. Upon this evidence, the officers who had undertaken the research recommended that further experiments should be made; these have now been carried out at H.M.S. *Collingwood*.

These trials were in two phases; in the first, trainee mechanics were put on to wholly programmed instruction for a portion of their training, this time with programmes specially written for the purpose and designed for use with Grundytutor and Autotutor machines. Results, however, were not as good as the earlier experiments had suggested that they might be; on the whole, classes that had been taught by an Instructor scored significantly better than those who had learned from the teaching machines. This led the experimenters to adopt a compromise development in which the aim was to exploit the saving in teaching man-power that the machines undoubtedly offer. Thus the next phase of the experiment takes the form of what the Navy has described as "Integrated Programmed Instruction". In this scheme, one Instructor Officer was made responsible for two classes of trainees who were to follow the same course in electronics that had been used in the previous experiment. This time, however, the classes spent only forty-two per cent of the available time on programmed instruction, which was now expected only to deal with the conveying of purely factual matter to the students. Of the remaining time, about half was spent in laboratory work and the other half in tutorial sessions with the Instructor Officer. By allocating sections of the classes to these three activities simultaneously it was found that the one Instructor Officer, assisted by a Chief Petty Officer, was able to control the two classes adequately, whereas under previous systems a team of one officer and one P.O. had been allocated to every class.

Not only was this saving in man-power achieved, but it was found that the classes working on the integrated scheme progressed significantly better than either the groups that had worked previously on a wholly programmed course or the control groups who had been confined to normal teaching techniques. These results seem particularly interesting as the protagonists of teaching machines have always maintained that one of the greatest benefits that the machines can confer is that they relieve a teacher of the comparative drudgery of purveying facts and release him for the more important educative function of tutorial.

It can be seen that the Royal Navy is making a significant contribution to research into the use of programmed instruction. Experiments are continuing in H.M.S. *Collingwood* and other shore establishments and an interesting extension has been made in that two teaching machines, with a small library of general-education programmes, are now at sea in H.M.S. *Centaur*. Results from this trial are not yet available, but it seems to the authors that the greatest potential of teaching machines for Merchant Navy training does lie in the use of machines aboard ship. If the Royal Navy experiments have shown that machine-instruction is generally as effective as teacher-instruction, then there would seem to be little doubt that a teaching machine is likely to be much more effective a means of teaching than the conventional correspondence course upon which a Merchant Navy apprentice is forced to rely for the major part of his studies at sea. The development of sandwich courses both for engineer and deck apprentices demands far more rigorous study at sea and it is very doubtful whether correspondence courses will be able to provide this need. The inevitable delays in postage cause a long period to elapse between the submission of completed work for marking and its return to the student, a period in which a student is likely to have lost most of his interest in the work concerned with the result that he tends to be largely indifferent to the comments and corrections that have been made by the tutor. A teaching machine, with its immediate correction and reinforcement, seems to provide the ideal means of instruction at sea.

THE POTENTIAL OF SINGLE-CONCEPT FILMS

For some fifty years now, the entertainment value of the cinema has been realized and exploited and for a scarcely shorter period, the value of educational films has been appreciated and used all over the world. Since the last war, an ever increasing number of merchant ships has carried a 16 mm. film projector and it is now commonplace for there to be a weekly film programme aboard ships. Primarily, such shows are purely for entertainment though, in recent years, the Seafarers' Education Service have been providing films of a generally educative nature for showing aboard ships.

However, the development of films on specifically professional topics has been slow and this is inevitable. The cost of even a ten-minute instructional film can run into thousands of pounds with the result that the professional makers of educational films will confine their choice of topics to those with a very wide appeal. Thus, there are many excellent films on mathematics, science and geography, for instance, and a few of these may be of some use to engineer and deck apprentices at sea. No commercial film-maker, however, is likely to invest money into the making of a film on such a topic as "Withdrawing the tail-end shaft" with the result that the young seafarer tends to be neglected in the field of instructional films.

At last, a solution seems to have offered itself in the shape of a new type of ciné-projector, the 800E, which is available at a cost of about sixty pounds. This machine closely resembles, and is about the same size as a normal domestic television receiver. Under the screen is a single knob (the only control), which combines the functions of an "on/off" switch and a focussing control. Alongside this knob, there is a rectangular opening, into which can be inserted a casette containing about fifty feet of silent coloured film. All that is required of the operator is that he plugs in the casette, switches on, focuses and he can then watch the four-minute film as many times as he wishes. The film is wound in a loop, so that lacing and rewinding are both unnecessary.

That this has potential for instruction, and especially for instruction at sea, should be plain. If a ship could be provided with one or more of these comparatively inexpensive machines and with a library of casettes, each one covering a different nautical topic, an apprentice (or any other member of the crew, for that matter), would be able to select the casette relevant to his needs, plug in, switch on, and study the film of his choice.

This, however, is not the major advantage of the equipment. This lies in the fact that the casettes contain 8 mm. film, film that is cheap to buy and to process and that is used by thousands of amateur ciné-photographers. Now, for the first time, it becomes feasible for the Merchant Navy to make its own instructional films; the authors have made single-concept films at a cost of less than two pounds each and, after prior planning, the shooting of each film takes little more than two hours. Any number of treatments can be adopted for these short films. If a mechanical skill is to be taught, an operator can be shown performing the whole task, and then the separate components in close-up and in slow time. If the operation of some machine is to be shown, simple working models can be made from ply-wood or card-board, disc-magnets affixed to their rear faces and each stage of the operation set up on a magnetic board and filmed in sequence. More elaborate animation can be achieved by using an overhead projector in conjunction with a magnetic board. A film to illustrate the buoyage system, for example, can be made by projecting the image of a channel, which can be changed at will, on to a white magnetic board. Model buoys and ships can be magnetized and then placed in appropriate positions on the board. If a series of shots are then filmed, the illusion of a changing scene is easily created.

To make the 800E projector an effective teaching technique for use at sea, the main essential would be the building up of a film library of sufficient size to make the usage of the projector economic. This is clearly a project beyond the scope of an individual, however keen and enthusiastic he may be. However, it seems possible that some of the larger shipping companies might invite officers to contribute short films for inclusion in such a library or, better still perhaps, the Merchant Navy Training Board might be persuaded to undertake this task.

The same manufacturer is also marketing a smaller projector of 8 mm. casetted films, the 250. This is much more easily portable than the 800E and relies upon a small, independent back-projecting screen for producing the image. The general principle, however, is the same in each case. A more elaborate (and very much more expensive) projector of this type is the Cinephonic Sound Repeat Projector. This, as its name suggests, projects sound film from casettes and allows for a running time of up to twenty minutes so that each film may, perhaps deal with more than a single concept and may also provide its own spoken commentary. This, again, operates on 8 mm. film, but the addition of sound makes processing more expensive and also makes much greater demands upon the amateur film maker.

A further development with these projectors is suggested by the Empirical Tutor teaching machine described elsewhere in this paper.

As has been shown, it is both simple and inexpensive to shoot a four-minute instructional film and to have it inserted into a casette; it is also comparatively simple to write a short linear programme to accompany the film. This can either be written in the form of a small booklet or spoken on to magnetic tape. Small personalized battery-operated tape recorders are now readily available and could be used in conjunction with the loop projector. In this manner, the student's learning from the film can be both checked and reinforced and a more multi-sensory communication can be achieved.

Discussion

MR. I. S. B. WILSON (Member) in opening the discussion, said he was sure every one would agree that the authors had very successfully shown the scope of modern teaching aids and methods.

Captain Varwell, in his presentation, had limited himself in trying to analyse teaching techniques, and some might dispute certain of his observations, but it should be borne in mind that he was trying to explain the theory on which these machines had been based and had quite rightly been very critical in certain aspects of the ordinary teaching techniques.

Those who were interested in the education of marine engineers must always be prepared to look at any means which would assist the seafarer while he was studying at sea, and at the same time explore the possibilities of incorporating some of these aids in the full-time courses held at the various colleges.

Firstly, with regard to the magnetic board, it was obvious that the board was of considerable value in teaching the "rule of the road". Mr. Wilson was a little doubtful as to some of the engineering aspects of it but certainly it was an ideal aid for analysing two-dimensional motion in a single plane.

He was particularly interested in the portable tape recorder. Some years ago he had helped to write a correspondence course for marine engineers. It was very easy to be factual in such lessons but extremely difficult to convey to the student with sufficient impact the essential points so that the student could recognize, and hold the vital key. Recorded tapes geared to a suitable correspondence course might largely overcome this difficulty. Mr. Powell had not mentioned the price of the portable tape recorder. It might be better if the tape recorder were not too portable, especially when the ship was in port. Possibly a simplified deck recorder might be more suitable.

The problem of distribution of tapes was a very big one. He could not for a moment visualize handing out tapes to all and sundry who required a correspondence course. Possibly a better plan would be to make available a set of tapes to a particular vessel so that a group of marine engineers, engineering cadets and deck apprentices, could make use of the one set.

He suggested that the marine colleges should explore this question of tape recording, and if some value could be found for the uses of this type of aid, industry could then be approached for its co-operation.

Regarding the overhead projector, he had had some experience with this, and it was clearly a very valuable aid which would be very suitable, for example, in a smoke room on board ship where there was no blackboard space and no large accommodation for a classroom.

He had had no experience at all with teaching machines. The linear programme machine seemed to be in a sense just an aid to the normal method of teaching. Many years ago, when he was studying mathematics, one of the books he had greatly enjoyed was by Saxelby, who must, he now realized, have used the linear programme, as he would take his readers through a very simple stage of calculus, and then give something like thirty or forty examples all based on that simple step.

The branching programme machine could be described as a teaching machine. There had been some tests carried out by the Royal Navy, and according to the paper, the results appeared to be in favour of the machine. But a note of caution should be sounded here. The students involved would be first-timers, they would know this, and their responses would probably be a little above average. How had trigonometry come to be chosen for programming? Was it that this was a suitable subject? Could a similar result have been secured with entropy?

The heart of all these teaching machines was, of course, the programme material, and these cost between £5 and £15 a copy. Some of the American programmes cost as much as £100 a copy.

In the marine world it was necessary to key the work to the syllabus of the Board of Trade, and this would no doubt involve specially produced programmes at extra cost. What was the copyright position in relation to these programmes? Was it possible to buy a programme from one manufacturer and use it on another machine? Could a programme be bought and then altered to suit a particular course?

He thought that these machines were a long way yet from being used on board ship. It might well be found, however, that these modern aids and teaching machines would prove very valuable to the full-time courses in the marine colleges, where there was a continual battle with an expanding syllabus in a set period of time. Perhaps the experience teachers were able to gain from the use of these aids ashore, would point to the way in which they could most usefully be adopted at sea.

One of the easiest things in the world was to make education expensive. The greatest problem was not in persuading educational authorities or industry to purchase these machines and aids but in understanding their true potential and being able to justify the use of them.

MR. J. HEIGHWAY (Associate Member) said that it was obvious that the major point was programming, and without an efficient and well devised programme the machine was useless.

The authors had suggested that experienced teachers should not be deterred from trying their hand at making programmes. Was this really wise? They stated that it was becoming a technology in its own right and he was a little inclined to feel that it should remain such. If the programme were not constructed properly these teaching machines could be rather dangerous when used on board ship. This also applied to the single concept film where the authors had suggested that officers might be requested to make certain films to be included in the ship's library. There might be a tendency for people with more interest in photography and without quite the necessary technical knowledge to make a film of this nature. This, too, could be rather dangerous, in that important details could be omitted.

He was under the impression that teaching machines were not being used very extensively in education establishments ashore. Was this in fact so, and, if so, why, in view of the lack of teachers heard about so frequently?

It would appear that before these modern methods could be usefully employed at sea a wider and successful use must be seen ashore. The majority of ships probably carried only two engineer cadets and two navigating cadets, because of this it would be difficult to assess the benefits the teaching machine might have.

One of the major stumbling blocks to private study at sea was the student's lack of motivation. This had been mentioned in the paper with regard to correspondence courses. The same lack of motivation might be found in relation to teaching machines once the novelty of operating them had worn off.

It would be interesting to hear the authors' views on how this problem of lack of motivation could be overcome. If the problem could not be solved there could hardly be any more success with teaching machines at sea than there was at present with correspondence courses. For this reason he did not agree with the authors' statement that the greatest potential of teaching machines in the Merchant Navy lay in their use at sea.

Mr. I. S. B. Wilson had suggested that they could be used in the colleges, and he agreed that their greatest use might well be in the colleges ashore.

If the evaluation of the results from the Royal Navy tests could be relied upon (and after seeing the examples shown at the meeting he was sure they could), it would appear that the teaching time ashore could be reduced if these machines and methods were used to good effect, and the extra time gained could be put to good use in tutorial periods or in laboratory work, or in possibly reducing the time of the apprentice ashore. He would be pleased to have the authors' views on this.

MR. A. H. WILSON (Member of Council) said he also would have liked to know something more about the costs of these latest of teaching aids and their relative value to the students. A very cheap teaching aid was mentioned in the context of the paper but it had not been shown in use.

Whatever engineers and shipowners had thought in the past, their thoughts today were changed, and there was now search, research and analysis of methods of learning going on which surpassed all previous efforts.

What he sincerely hoped was that somebody would synthesize all the good things of the past in order that what was achieved was not just a change but some real progress which could be seen and measured. He made this point because there was a lot of analysis going on which was not really progress. He realized that some of it must go on but he would have preferred at the end of it, to pick out the good things and include them in something for the future.

Teachers of marine engineering knew well the big variation in the levels of intelligence and mental capacity their students possessed on entering a course, but many of the minds had not been developed, so these qualities did not change at the same rate with increasing knowledge and experience. This variable change made the teachers' task even more difficult.

The teacher had to develop not only the memory and the mind but also the senses of touch and sight. He mentioned the last two because the authors did not appear to have considered the laboratories as places that contained teaching aids.

All modern steamships, he imagined, had a small chemical laboratory, and, of course, the *Otaio* training ship, which accommodated apprentices of both deck and engine room, had student laboratories for physics and mechanics. In these laboratories sight and touch, as well as the mind, were developed to the full.

When the authors stated, near the beginning of page 208, that there was traditional prejudice against full time courses ashore, did they really mean "prejudice"? His own understanding of the position was that the taking of such courses used to put one out of employment, consequently there was a deep-seated aversion to them.

Was it right to think that basic information should be given early in a course and memorized, and was best taught in a linear programme, whereas when appropriate information had to be selected from the mind, this was best done in the branch type of programme?

Most educationalists would probably say that marine engineers had less knowledge of mathematics than those in other branches of engineering, and in many cases he believed this to be true, in which case it slowed down the teaching of other subjects. There was, he felt sure, a clear opening here for programmed learning at sea, especially if a college could produce a programme for one of the under-£2 machines. After all, a good book could not be obtained for less than £2 today, and here was a teaching aid being provided which would teach many people and which could be used more conveniently than a book.

Would the authors say where training to write programmes was given? When the post-certificate stage was reached business management and organization became more important. Did the authors think that basic ideas on these subjects could be best conveyed to students by means of the tape machine or, better still, the cinematograph sound projector, for which an expert speaker could give the lecture and describe diagrams drawn up by an appropriate professional writer? These could be repeated to suit the critical or slow student.

He could, of course, see also a wider range of topics such as might be termed social subjects. These were necessary to the seafarer whose brain was like that of the landsman but whose environment and opportunities for social contact and learning were quite different.

In this connexion he had been sorry to learn that at a recent conference it had been pointed out that the suicide rate among seafarers had increased rather more than among people living ashore.

The Committee which had been formed to look into "Teaching Techniques for Use at Sea" had a novel task and when the report was available he would like to listen to another paper by these authors on their views of the Committee's findings and proposals. If, as he understood, the authors were members of this Committee, they might be saved the trouble of having to write a minority report. A report from a Committee usually contained some things which were not of first importance to all members, and a paper would afford an opportunity for a specialist in the teaching field and in using these instruments, himself a seafarer, to give a fair indication as to what was wanted from a machine and what existing machines were capable of doing.

MR. F. D. CLARK (Member) said that motivation had been mentioned by the authors and by the speakers in the discussion. He would have thought the motivation should come from the man himself—the necessity to learn and make more money in order to live. That was the sort of motivation that did and should apply to many of the young marine engineers at sea. What had been emphasized was that the poor, lonely engineer at sea (he was not so lonely really) missed the motivation of the parent, of the teacher at school, of the lecturer at the college. To some extent this was right, and in that respect he would support, certainly in the early stages, the adoption of the tape recorder. He was not very familiar with all the mechanisms of the tape recorder but he believed that two- and four-track tape recorders were available, and with a little adaptation it should be possible to have the lecturer on one track, or even questions on one track, so as to enable the fellow at sea to give his answers and reactions, and his questions, too, on the alternative tracks and send this back to the college and let the lecturer come back again with his further answers, questions and comments. In this way there would be a verbal contact, albeit from a machine, which was what was considered so desirable for the man learning on his own at sea. He put this forward as a suggestion.

MR. G. R. HODGE (Member) said that the general trend of the remarks made so far was to the effect that the method of training marine engineers should be improved and made more efficient. In his own opinion it was not possible to replace the lecturer in the classroom, and probably many of these aids were a good supplement to the classroom lecture.

A lot of these aids were being used now and they must be used wisely. They could only supplement the lecturer. Correspondence courses had been tried for the man at sea, and obviously it was difficult always to find the time to learn and study at sea. Text books could not be replaced but the present material should be supplemented with tape recorders, film and written lessons. He did not think it was possible to cut down the actual time spent by the man at school, or to increase the rate at which the man could assimilate knowledge. A man had a more or less fixed rate which could not be exceeded, so that although these aids would obviously make teaching more efficient, the actual time spent at school could not be cut down. Some of the work, as had been pointed out, could well be done at sea, and if the normal correspondence course was supplemented by film and the use of projectors this would merely increase the efficiency. The man perhaps knew a little better what he was going to write about in the examination, or knew a little better about the machinery with which he was working.

Another point which could not be stressed too highly was the great variation in the level of the students who had to be dealt with. Unfortunately, they were not all within a general level like a Higher National Certificate or National Certificate course; there were wide variations at sea and in college and it was very difficult to get together material for presentation in a machine to suit all these different levels and obviously although the lecturer in the class could adapt himself to the student, again one came up against the problem of the individual student, so that most of the equipment had to be supplementary to the teacher, the book, and probably the correspondence lessons.

Mr. K. J. Shone, M.A. (Cantab.) (Member) wondered how necessary a teaching machine was in programmed learning —whether it would not be possible to have a programmed text and use the method of the teaching machine without having any buttons to press? If the motivation were there the programmed text might be just as good as the teaching machine, for which there was a tremendous future, without doubt.

Would not the big effect of the work on teaching machines be to bring about an improvement in correspondence courses by making use of the questioning method, the small slides and the guide?

He wondered to what degree the programming ought to be left to the professions. Could sufficient guidance be given to people in the field, in far away places, to enable them to try it with a good chance of success? It might improve their teaching if they were asked to prepare something. It would in a way be a method of checking up on the teachers.

Mr. E. F. Dawe (Associate Member) said that he was probably one of the few people present who had actual experience with teaching machines. Having introduced one or two initially they were still only really in the experimental stage. The essential thing about the teaching machine was that it dispensed with the teacher. The programmes used were academic topics only. Whether the machines would be particularly suitable for the more practical aspects of marine engineering he would hesitate to say, but they had been found successful. The students were shut away without a teacher; they were just visited from time to time to make certain they had not disappeared. The ITM type of machine was used with the programmes on a 35 mm. film. The programmed texts might well be more attractive, in that they were much cheaper to buy—the machines were rather expensive—but he suspected that they were much slower. They had not any programmed texts yet and were only using the fully-fledged machines.

One or two programmes had been produced at his college. It was a very difficult task and had to be done very carefully, so that a long time was involved.

Some speakers had commented on the level of the persons using the machines. This would present a problem but the majority of the programmes were devised so that they were aimed at a particular level and usually there was some form of test given prior to a student being committed to using a particular programme.

With regard to Mr. I. S. B. Wilson's comments on cost, he worked for an education authority and found it very difficult to persuade them to buy any teaching aids at all.

Mr. D. J. Lochhead (Member) said that in discussing teaching machines, teaching aids and programmes the first thing to consider was who was being taught and why.

Courses for seafearers had grown rapidly in number and complexity during the last fifteen years. He was referring now primarily to apprenticeships. The original Ordinary National Diploma alternative scheme was not very dependent on theoretical study at sea during Phase II, as the O.N.D was completed in Phase I, and Phase II was planned to provide practical experience.

In the second stream the Ordinary National Certificate was taken in Phase III. The two year college courses for Phase I covered the G and O.1 stage. Students then went to sea for Phase II, returning later to take the O.2 course during their Phase III training.

Obviously re-phasing was advantageous in this scheme, since by taking Phase III before Phase II a student could complete his O.N.C studies without interruption. On the other hand, it could be argued that students should gain seagoing experience as soon as possible. In this case they must keep up their level of knowledge during Phase II so that they would be ready for their O.2 studies when they returned for Phase III.

Suitable revision correspondence courses had been devised to bridge the gap but they imposed an expensive marking load on the colleges concerned. They were also inherently unsatisfactory, since correction and reinforcement arrived too late. The introduction of teaching machines might be the solution to this problem.

It would appear that a branching programme would probably be preferable for revision courses such as this since they were not so tedious for the more able student.

Unfortunately, these programmes were too expensive to permit unnecessary duplication and some central organization would be necessary to avoid this.

A scheme had recently been initiated to determine the best methods of study at sea and much more information on the subject should be available by 1967. Several investigations into programmed teaching techniques had already been made, and perhaps the authors would say whether there was any evidence at present to indicate the relative merit of linear and branching systems on courses similar to nautical subjects.

With regard to motivation, this worried him considerably because some colleges offered free preliminary correspondence courses for adult seagoing students who enrolled for full-time courses. It was surprising to note that over fifty per cent of students who enrolled for preliminary second class engineering courses did not complete the first set of exercises, despite the fact that they were deliberately made very simple as an encouragement to further study.

There had not been much comment in discussion on the authors' mention of the film strip and the 2in. × 2in. slide. These had been developed by a number of colleges to illustrate lectures on machinery, components and installations, particularly in the senior courses for adult students. These film strips were cheap and robust, slides were robust if enclosed in glass, and were easily stored. By means of a simple organization most colleges could produce them rapidly to meet the requirements of individual lecturers.

If this were to be adopted generally, or for use at sea, the co-operation of shipbuilders and engine manufacturers would be necessary, as original photographs were rather difficult to obtain.

Commander E. H. Davies, O.B.E., R.N. (Member) tended to agree that "sitting next to Nellie", by tradition, played a very large part in, and took up a large proportion of, the life of a trainee in industry; but from the point of view of craft apprentices and certain machinery operating techniques he would not have thought it wrong that "Nellie" should play a considerable part—providing, of course, that "Nellie" was attractive, had the right background and expertise, and remained admired, from the purely teaching point of view, by the youngster concerned; particularly where the medium being worked and the tools required for the job did not change for many years.

But in this day and age it was necessary, occasionally, to get away from "Nellie" for short periods, in order that these youngsters could be given a fair quantity of theoretical "knowledge", as opposed to "know-how". He was sure that in future years a great deal more use would be made of visual aids, magnetic strips, projectors, and programmed instruction, in industry generally, and particularly in junior and elementary schools. He wondered sometimes, however, whether these teaching aids were being used in schools to teach under the older traditional systems —for example, whether arithmetic and mathematics were still being taught from the basis of the two and seven times table instead of by the laboratory approach of quantities, and whether geography was still being taught on these machines by means of rivers, places and mountains, instead of by economic facts affected by geographical factors.

Would one of the authors please say whether, apart from the methods used for teaching, there had been in recent years any changes in the way that particular basic educational subjects were approached these days as compared with say, thirty years ago.

The authors had mentioned cadet ships in the printed paper, and Commander Davies' company was the one that carried the qualified, full-time lecturers or teachers for engineer cadets under instruction on board. It was believed that motivation existed in these ships because cadets in fairly large numbers, both deck and engineer, had to live and work together for considerable stretches of time and had to compete continuously with each other with regard to progress in work and in examinations. With smaller numbers this would not be gained as effectively.

As far as aids to lecturers were concerned, the company used a projector similar to the one shown that evening and, as Mr. Wilson had mentioned earlier, there were in the cadet ships, the important ancillaries of workshops and laboratories for qualitative and quantitative work. It was essential to get "physically in touch" as well as to gain professional knowledge. The navigating cadet would get it by his training by exposure on deck and bridge; the engineer cadet by contact with the laboratory and workshop and the material and operating side of his training.

He believed there was a balance to be achieved between learning from teachers, from teaching aids, from laboratories, from books, and from one's colleagues, and they like others would need to continue to endeavour to reach as fine a balance as was most effective and worthwhile.

Correspondence

Mr. H. D. Makinson wrote that it was stimulating to read of the positive efforts and methods now being made in regard to teaching aids at sea. For the teaching of marine engineering apprentices and junior engineers it appeared to have great potential. It might well be that some adaptation of 'Integrated Programmed Instruction' described in the paper could be used in technical colleges operating the Alternative Training Scheme.

The information relating to the experiments on H.M.S. *Raleigh* and H.M.S. *Collingwood* was very interesting. Could the authors state the numbers of trainees in the classes concerned? Was any information available on the use of programmed books or booklets by Royal Naval educational establishments? In this respect he wondered whether the Royal Navy had found them to be as useful as industrial concerns such as Baker-Perkins of Peterborough, who appeared to have applied the programmed booklet technique very successfully for their apprenticeship schemes.

The programmed booklet appeared to offer greater flexibility than the more sophisticated teaching machine when used standing before a machine in a workshop or machinery space. Certainly it appeared to be the only programmed 'machine' that the individual teacher could pursue and develop on individual topics for mass use by a class without recourse to large financial outlay.

Authors' Replies

In reply, Mr. Powell, referring to Mr. I. S. B. Wilson's comments, said that the magnetic board was extremely useful in talking about mechanical movements. Illustrated on a chalkboard, a cam-operated mechanism, for example, might entail constant rubbing out and redrawing, whereas the shapes on a magnetic board could be moved around with no interruption in the visual continuity of the sequence. There was, of course, no reason why a magnetic board should not serve also as a chalkboard, when the static elements in a diagram could be drawn in the usual way.

Portable tape recorders could be bought for about £20 (Japanese) and the one he used cost about £32.

As far as copyright was concerned, the same conditions applied as in the case of text books. Programmes could be altered provided they were used within the confines of one's own room, just as pictures could be abstracted from a published book and projected on to a screen without payment of any fee for so doing. That was, of course, provided it was not done at what was commonly regarded as a public performance.

Mr. Heighway had spoken about teachers programming. This was an interesting topic for discussion at the moment. There were opportunities for teachers to learn how to write programmes since courses were available at certain technical colleges and similar institutions. However, it had been found that the most successful programmers were frequently those who, although highly intelligent, knew nothing about the subject they programmed before they came to write it. They therefore had to go through the business of learning the subject themselves, and then putting it down as a programme. There had been some excellent programmes from people who knew nothing about the subject before they started programming: there had been excellent programmes from teachers. The debate continues.

A programme took a long time to write, and if it had been properly validated it would pass the basic test, which was to teach the people for whom it was designed. If it did that the programme could be said to work.

He would not go so far as to believe that linear programmes and branching programmes were as different as Mr. Wilson had suggested. One school of psychologists following the work of Professor B. F. Skinner believed the linear programme to be the most efficient route to learning; another group following Dr. Norman A. Crowder, believed the branching programme to be more efficient. However, there were rather more branching programmes available than linear at the moment, so that branching programmes seemed to be in the ascendancy.

Mr. Clark had mentioned motivation to make money, and this was important. It was part of the wider desire for social approval from the group one admired. This was a principal psychological factor influencing motivation. The possession of money, in our Western culture, was one of the means of attaining this approval. The other basic motivating factors were the desire for self-esteem and the need to survive, the latter being largely satisfied in a normal healthy student. One of the mainsprings of self-esteem was the immediate knowledge of any success that might be achieved. Teaching machines were programmed to provide students with information about their progress without delay: they therefore motivated the student to persevere. Correspondence courses, however, by their very nature could not motivate in this way to the same degree if, indeed, they could do so at all.

The tape recorder had really come into its own in language laboratories, and those industrial organizations that used tape recorders for training people who were going abroad, found that they could train them in a language from scratch, in something like thirteen weeks.

Mr. Hodge had pointed out that teaching devices could not replace the lecturer, and this was true. However, it was a fact that about half the population did not naturally turn to reading books for information. They tried other means first and then if all else failed, they read. One just could not compel people to study by reading books. Devices released the lecturer from unnecessary repetitive drudgery for the more vital and valuable function of being a human source of inspiration, encouragement and guidance through personal tutorial work.

Depth of insight varied greatly, and even if teaching devices did not make people learn more quickly they might help them to learn more deeply.

Mr. Shone had asked whether the machine was necessary. It had been found that in certain instances people would go on using a machine when they would give up a programmed text book. In the absence of another kind of external motivation, it was the delight of pressing buttons to some purpose and finding that one was continually right, which seemed to have a distinct edge on the book.

Mr. Dawe had found this with his students, and he reminded the meeting how long it took to produce a programme. It would be unwise for a very busy teacher to commit himself to writing a programme without making quite sure that he realized it would take many hours of work to complete over a period of perhaps two years.

Mr. Lochhead had spoken of the importance of film strips and 2 inch square slides. In this context a tape recorder could be connected to drive the slide projector and in that way there could be an automatic presentation in which the student heard what the lecturer had to say and saw his diagram in the right sequence at the right time.

Commander Davies and the training which he administered represented a truly progressive attitude to nautical education. In many schools arithmetic was now being taught in a new way using various devices. It was aimed at teaching young people to enjoy what they were doing and to see what it was all about; to appreciate the patterns and the meanings of numbers and their groupings. It was proving to be extremely successful. There was also a new reading method, using the initial teaching alphabet, in which more people were taught to read more quickly than hitherto, and there were exciting new developments in the teaching of science. There were even new subjects. He agreed with Commander Davies that we should try to achieve a balanced presentation and this could only be realized if the potentialities of all the reasonable ingredients were explored.

In replying to the discussion Captain Varwell said that in a written question from Mr. Makinson and in a verbal question from Mr. I. S. B. Wilson, reference was made to the Royal Navy's experiments with programmed learning in H.M.S. *Raleigh* and

Collingwood. These experiments had been written up in considerable detail, but they had extended over several years with the result that it was difficult to obtain an aggregate figure for the number of students involved. However, the duration of the research would seem to indicate that any "novelty value" would have been well and truly worn off and hence it would belie the suggestion that the success obtained was of purely ephemeral nature. Moreover, these experiments did appear to have established that the use of machines was preferable to that of programmed texts though there could be no doubt that the latter did teach effectively. Whilst many industries were making use of programmed booklets for instructional purposes, others, such as British European Airways, had, after exhaustive research, come down in favour of the teaching machines.

Mr. Wilson had gone on to ask why the Royal Navy had used a programme on trigonometry for their initial experiments: the research was commenced in the very early days of teaching machines in this country and there were very few programmes available. The Instructor Officers concerned had to find a programme that was relevant to one of their courses and one that was available both as a text and for use in a machine. The programme on trigonometry was the only one that fulfilled all these requirements. In nautical education (and the word was used here in its widest senses to embrace the engineering, radio and deck sides) there could be no shrinking from the fact that if teaching machines were to be used at sea then the majority of the programmes would need to be specially written for the purpose. Moreover, since some machines carried their programmes on 35 mm. film and others on specially folded pads of paper, each programme must be produced with a particular machine in mind. Programmes were not readily interchanged nor could they be easily amended.

In his contribution to the discussion, Mr. Heighway suggested that it was dangerous to ask serving officers to contribute film that might be used for teaching purposes in conjunction with one of the 8mm. loop-film projectors. The authors would agree that few officers would have the necessary knowledge to complete a teaching film unaided. However, if such an officer had the interest to shoot 100 feet or so of film to record some unusual engine repair that occurred aboard his ship, there were many nautical teachers who would be competent to undertake the necessary editing that would convert this raw film into an excellent four minute teaching film.

A further point that was raised by Mr. Heighway, emphasized that teaching machines had shown quite clearly that their use could substantially reduce instructional time. This was true, and, properly used, they could free teachers and students for far more valuable tutorial contact hence increasing the educational value of the courses. If those involved in nautical education were able to feel complacent about the educational content of their courses then, and only then, should they think in terms of the time saved by teaching machines being used to reduce the length of courses.

Several speakers attempted to contrast teaching machines with conventional correspondence courses; Mr. A. H. Wilson was curious as to the level of work to which programmed learning was particularly applicable and went on to suggest that perhaps films and audio tapes were the best medium for giving to senior officers the guidance that they needed on such topics as management and organization. In the authors' experience such aims were best furthered by techniques like group discussion and syndicate analysis; it was at this level and in this field that face-to-face exchanges between people become of paramount importance. At this stage it was far more a matter of attitude-reorientation than of the mere purveying of subject-matter.

In his contribution, Mr. Lochhead commented upon the enormous expense involved in the marking of a conventional correspondence course. In one course with which the authors were familiar the time spent in marking was equivalent to that of about ten full-time members of staff which could mean an annual expenditure of some £15,000 on marking alone. The average period that elapsed between an apprentice at sea finishing a particular piece of work and the return to him of the marked script was probably some two to three months and by that time, of course, he had lost all interest in the work that he did and had little incentive to profit from his tutor's comments. The same criticism would apply to any exchange of tape recordings between the student and his tutor. On the other hand, a programme immediately corrected the student's work and gave to him the knowledge of his success that was so vital to learning.

INSTITUTE ACTIVITIES

Section Meetings

Kingston upon Hull and Humber Area

On Tuesday, 22nd June 1965, senior and junior members of the Section made a visit to the works of Messrs. Ruston and Hornsby Ltd., at Lincoln. Members gathered at the New Holland Ferry Terminal in Lincolnshire at 10.30 a.m. and left for Lincoln by coach. Due to a slipping clutch and adverse weather conditions the coach arrived in Lincoln about thirty minutes late, but despite this setback the visit was soon in full swing.

The party was welcomed by Mr. C. J. Hind, Engineering Director, and after coffee, saw a film which showed all aspects of the work carried out at the works. A quick, but extremely interesting tour of the Research Centre followed, when many types of engine under test and development were seen.

The directors entertained the party to lunch after which the afternoon was spent inspecting all stages of the manufacture of Diesel engines ranging up to 4,000 h.p.

A pleasant, uneventful journey back to New Holland ended a most enjoyable and instructive day.

Kingston upon Hull and Humber Area Section

Members of the Section waiting to board the return coach after a works visit to Messrs. Ruston and Hornsby Ltd., at Lincoln. On extreme left: Mr. MacAlister-Smith, Marketing Officer of Ruston and Hornsby, who looked after the party throughout the day, and, on extreme right: Mr. R. Rawlings (Vice-Chairman of the Section) Technical Manager, who organized the visit

Election of Members

Elected on 19th July 1965

MEMBERS

James Gordon Armstrong
George Bailey
Daniel Hugh Fairney, Eng. Cdr. (E), R.C.N.
Harry Flegg
George Howard Barron Noel Hunter, Cdr., O.B.E., R.N.
Christopher William Peters
Ronald Scotwick
Leslie Stewart Simpson
Oscar Slater Stevenson
Stanley Tattersall
Douglas Taylor

ASSOCIATE MEMBERS

Peter Ballinger
Arthur James Bland
John Roy Bullock
Colin Hunter Cadenhead
Douglas James Cousins
Alfred Davison
Jan Hendrick De Haas B.Sc. (Tech.) (Manchester)
John Craig Edon
Kenneth John Evans, Eng. Lieut. R.N.
William George Finch
Singleton Gardiner
John Gilburt Godfrey
Arthur Goodman
John Barrie Gordon
Edward Adrianus Haksteeg
John Edward Hobson
Ir. Harry Hendius, Dip. Ing.

Frederick Johannes Horn
Frederick James Hughes
James Clive Hughes
Angus Beaton Hynd
Samuel Archibald McLeod
William David MacPherson
Michael Mableson
Edwin Michael Marks
Noshir Jal Mistry
Geoffrey James Fitzwilliam Mobsby, B.Eng., (Liverpool)
Bernard Finbarr Morrissey
William Mackenzie Murdoch, Lt. Cdr., R.N.
Leslie James Nicol
Edward Henry Patterson
Hugh Campbell Redrobe
Allen Riley
Robert Rogers
Robert Edward Rushton
Thomas Frederick John Russell
Ajitinder Singh Sodhi
Brian Sutton
Kamal Kumar Tandon
Ronald Howard Watkins
Derek Wilkinson
John Anthony Wylie

ASSOCIATES
Evert Simon Barens
Brian Buckle
Kenneth Michael Clarke
George Henry Greggor
Arthur Phillip Harding
Graham Jones
Kona Kannan Naidu
Arnold O'Neale Neckles, Lt. Eng., T.T.C.G.
Anthony Joseph Nolan
William Haydn Phillips
Albert Rothman
Ernest Arthur Sharpe
Leslie Denis Slater
Alfred Edward Waine, M.B.E.
David James Wallace
Edgar Arthur Way
Joseph Peter Wilkinson

GRADUATES
Pedapudi Bhaskarachary
Alexander McPherson Dalton
Paul Anthony Dodd
William Dowie
David George Kendall
George John Kosanovich
Robin Mackenzie Lawrie
David Edwin Mainwaring
Robert Michael Sands
Charles Geoffrey Shepherd
Rodney Nelson Stannard
Michael Swift
Gerald Dennis Verrill
Peter Wareing
William Edward Watson, B.Sc. (Newcastle)
Keith Winpenny
Han Chong Wong

STUDENTS
Anil Kumar Agarwal
Surinder Kumar Aggarwal
Harish Kumar Arora
Swami Behari Asthana
Lalit Mohan Bahl
Gyan Chand Bakshi
Vimal Kumar Bammi
Biplab Bandyopadhyay
Prabhat Banerji
Pranab Basu
Ranjan Kumar Basu
Sam Faredoon Behramfram
Inder Pal Bhatia
Subhash Chander Bhatia
Ashish Kumar Bhattacharyya
Sunil Bhusan
Baldev Raj Chandla
Sunil Madhav Chati
Vilas Chaubal
Shiva Kant Chaudhary
Balbir Kumar Chhabra
Krishnamurti Chidambaram
Shashikant Mahadeo Chitale
Ashok Rajaram Chitnis
Chander Mohan Chopra
Chigurupati Achutaramayya Choudary
Ajoy Sinha Choudhury
Rana Ramesh Chowdhry
Manoranjan Das
Nitis Chandra Das
Kumaresh Datta
Dipansu Kumar Deb
Bhu Dev
Benedict Victor D'Souza
Morgan Bernard Dyas
Ekekwe Augustine Ekekwe
Rama Mohan Atluru Gandhi
Pradeep Kumar Ghosh
M.K. Girish
Pravin Kumar Goel
Sunil Kumar Gupta
Pranab Kumar Das Gupta
Samir Kumar Das Gupta
Som Dutt Gupta
Bhaskar Halder
Brij Mohan Hans
Syed Shafiqul Hasan
Subhash Amrit Rao Hattikudur
Christopher Hoddinott
Graham Edwin Horton
Vijay Kumar Jain
Vinod Kumar Jain
Bikramaditya Jaipuriyar
Jaiprakash Jaiswal
Jaswant Singh Jhans
Thomas George Joseph
Ambrish Kumar Kakkar
Lalit Kumar Kapoor
Prem Raj Kapoor
Ramesh Kumar Kapoor
Ravi Kapoor
Avinash Vasudeo Khadilkar
Najmul Majeed Khan
Rajendra Kumar Kharbanda
Satya Prakash Khare
Indarjit Singh Khuman
Sudesh Chander Khurana
Michael Gerald Kimpton
Derek Oxley King
Jacob Koshy
Panchakarla Murali Krishna
Bharat Bhushan Kukreja
Vijai Kumar
Vinay Kumar
Chithatoor Ramanathan Kumaraswamy
Ashok Kumargulati
Ranjeet T. Lalwani
D. P. Madan
Devinder Singh Malik
Subhash Chandra Majumdar
Lakhan Nihal Masand
Verghese Mathew
Anil Kumar Mathur

Balbir Shankar Mathur
Salil Guha Maulik
Arun Mehrotra
Rudradutt Mehta
Rajan Balakrishna Menon
Prashant Kumar Mishra
Digambar Misra
Tathagata Mitra
Prabir Charan Mukherji
Sujit Kumar Mukhopadhyay
Lalit Munjal
Matthew Okwuan Nwachukwu
Ram Lubhaya Ohri
Prosanta Kumar Pal
Ivor Ashley Joseph Patrao
Terence Frederick Pratt
Harindra Narayan Rai
Ramji Rai
Bharath S. Rajan
Rampal
Anand Rao
Kasarabada Venkata Suryanarayana Rao
Dipak Raut
Ralph Alban Raymond
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Shankar Sadhwani
V. S. Sahajpal
Haresh Kumar Sahu
Vilas Madhav Salvi
Bhuwneshwer Saraswat
Kommunaga Bhushana Sarma
Adarsh Saxena
Gautam Sen
Jagdish Ramiyengar Setlur
Krishnamoorthy Shankar
Amba Dutta Sharma
Satya Narain Sharma
Vinod Kumar Sharma
Vindhya Basini Ranjan Shrivastava
Arunagiri Shivaji
Arun Kumar Singh
Kunwar Shyam Pratap Singh
Mahendra Jeet Singh
Shiv Pratap Singh
Shree Pratap Narayan Singh
Shyam Ji Singh
Ashok Kumar Srivastava
Narendra Kumar Srivastava
Subhendu Kumar Sur
Prasun Tagore
Shobhan Talukdar
Girish Chandra Tewari
Narendra Kumar Tewari
Nishat Kumar Trivedi
Surendra Prakash Tyagi
Amiya Kant Varma
Sudesh Kumar Varma
Abul Barkat Misaqul Wahhab
Narinder Bir Singh Wadhwa
John Charles Wright
Ramesh Chandra Yadav
Ramlal Singh Yadav

PROBATIONER STUDENTS

Gerald Gwynn
Kenneth Robert Kitchen
Keith Rowbottom

TRANSFERRED FROM ASSOCIATE MEMBER TO MEMBER

Jack Macklen Bray
Arthur Dumble Kirtley
Kaushal Kishor, B.Sc.(Agra)
Peter Leck
Leslie Donald MacArthur
John Henry Miller
Robert Patterson
Kenneth Alfred Ross-Smith
Frederick William Sandow
Geoffrey Sydney Scoones
William James Wales
John Aitchison Wood

TRANSFERRED FROM ASSOCIATE TO MEMBER

Quintin Blane
Arakkal Thomas Joseph
Geoffrey David Turnbull
Patroclus John Yangos, B.Sc. (Mech. Eng.) Athens

TRANSFERRED FROM GRADUATE TO MEMBER

Geoffrey Edward Giles, B.Eng. (W. Africa)

TRANSFERRED FROM ASSOCIATE TO ASSOCIATE MEMBER

Cyril William Adams
Malcolm Norman Butt
James Brown Kerr

TRANSFERRED FROM GRADUATE TO ASSOCIATE MEMBER

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Francis George Broom
Barry Trevor James Coles
Robert David Cowin
Kaveseri Veetil Kesu
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Aung Pe
John David Pettifer
Derek Rhoden
John Scarth
Dharam Vir Taneja, Lieut., I.N.

TRANSFERRED FROM STUDENT TO ASSOCIATE MEMBER

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David John Morgan

TRANSFERRED FROM GRADUATE TO ASSOCIATE

Kersy Tehmurasp Chinoy
Donald Percy Springfield

TRANSFERRED FROM STUDENT TO GRADUATE

Michael Richard Adkins
Peter Robert Davies
David Phillip Bower Hibbs
Roger Lee
Tusharendoo Ramji Mistry, B.Sc.(Durham)

TRANSFERRED FROM PROBATIONER STUDENT TO GRADUATE

Derek Henry Bowdery
William Michael Wood

TRANSFERRED FROM PROBATIONER STUDENT TO STUDENT

David Leonard Evans

OBITUARY

Lennard Constantine Burrill, M.Sc., Ph.D. (Member 9798) died on 4th May 1965, at the age of fifty-nine.

Professor Burrill served his apprenticeship with Swan Hunter and Wigham Richardson Ltd., at their Wallsend shipyard. He took his degree in naval architecture at the University of Durham, after which he carried out post-graduate work there, on the stability of coasters and ship vibration.

He joined the Manganese Bronze and Brass Co. Ltd. in 1932 and, over the ensuing fourteen years, worked to improve methods of propeller design and manufacture. He produced many papers on this subject, one of which, entitled *Developments in Propeller Design and Manufacture for Merchant Ships,* gained him the Institute Silver Medal in 1943.

In 1945, he became Professor of Naval Architecture at King's College, Newcastle upon Tyne. Under his guidance, both the number of students and the provision of research facilities were increased greatly. He maintained an active participation in the work of improving propeller design, while at the university, and intended to present a technical paper in Russia this year.

Professor Burrill was elected a Member of the Institute on 8th February 1944; he was also a vice-president of the Royal Institution of Naval Architects and a Fellow of the North East Coast Institution of Engineers and Shipbuilders; he was, at one time, chairman of the cavitation committee of the International Towing Tank Committee and he also served on the hydrodynamics and vibration committees of the British Ship Research Association.

Professor Burrill leaves a widow.

William Henry Cross (Member 19128) died on 20th January 1965.

Born in 1920, he came out from England to South Africa in 1936, and entered the engineering trade. Here his ability soon became apparent when he won the Gold Medal of the Port Elizabeth Engineering and Scientific Society in 1937, followed by a Silver Medal in 1939.

Mr. Cross worked for a number of leading engineering firms in Port Elizabeth before joining S.A.M.A.D., where he worked for seventeen years, eventually rising to the position of project engineer and purchasing manager.

Mr. Cross, who was a member of the South African Institute of Welding, was a keen yachtsman and angler, and was very interested in the history of ships; he had a large collection of old shipping journals and books.

He leaves a widow and one son.

Louis George De St. Jorre (Member 5233) died on 16th May 1965, aged seventy-six, as the result of a stroke.

Mr. de St. Jorre was apprenticed with Ross and Duncan, Glasgow, from 1907 until 1912, after which he served at sea for ten years, gaining his First Class B.o.T. Certificate during that time. From 1924 he served as a seagoing engineer with the P. & O. Steam Navigation Co., until in 1934 he left the sea for a time to become technical salesman with Hall and Hall Ltd. During the Second World War he was a temporary overseer at the War Office.

In 1948 he became Assistant Superintendent Engineer of Construction and Shipping, R.A.S.C., Singapore.

He was elected a member of the Institute in 1924, and attended many meetings.

Mr. de St. Jorre leaves a widow.

James Kelly (Associate Member 21052) died on 3rd January 1965, at Fair Oak, near Eastleigh, Hants., at the age of 44. He left a widow.

Apprenticed with John Lynn and Co. Ltd., Sunderland, for five years, he then did four years' service in R.E.M.E. during the Second World War, and after this went to sea in 1947. He gained his First Class Steam Certificate while working for Overseas Tankships (U.K.) Ltd. in 1957. He eventually rose to the rank of chief engineer by 1962, when he left the sea, and was accepted for training at Wolverhampton Teachers' Training College, and afterwards took up a position as lecturer at the Southampton College of Technology.

Sydney Albert Sutton (Member 14666) died on 11th February 1965, at the age of 63.

Mr. Sutton served his apprenticeship with the Canadian Pacific Steamships Ltd., at the same time attending Bootle Technical School. From 1924 to 1937, he was marine engineer with Canadian Pacific and obtained his First Class Steam Certificate in 1934. In 1938, he went to the Ministry of Supply as mechanical examiner and later inspecting officer. Later, in 1951, Mr. Sutton was chief engineer, Ocean Weatherships, with the Air Ministry, and a second engineer with Manchester Liners Ltd.

He became a Member of the Institute in 1953.

Izhak Tovim (Member 19999) died in September 1962 from coronary thrombosis.

Born in 1927, Mr. Tovim was apprenticed at the Palestine Ship Repairs Co. Ltd., Haifa, and studied at the Haifa Marine School.

From 1946 to 1955, he went to sea with the Zim Israel Navigation Co. Ltd., serving aboard various ships as 5th to senior engineer, obtaining his First Class Steam Certificate in 1954. He then left the sea to work in the ship repair business founded by his father—Palestine Ship Repair Co. Ltd., as technical manager. He took leave from the business in 1959 to study for his Diesel Engine Chief's certificate, which he gained in December 1959.

Although he was a successful manager in the family business, his heart was always at sea, and each year, for his annual leave, he would sail for a month or two as relief chief engineer on a passenger or cargo ship.

His family and business acquaintances have chosen to commemorate him by setting up a Memorial Reference Library in his name, which will be housed at the Nautical College, Acre, for the use of the Israel Merchant Fleet and students.

Mr. Tovim left a widow and two children.

John Hodgart Dunlop Traill (Member 8162) died on 22nd May 1965, at the age of 75, after a long illness.

Mr. Traill was apprenticed with G. and J. Weir, of Glasgow, from 1904 to 1909, and at this time joined the R.N.R. In the First World War, he served with the Royal Navy in destroyers and sloops. After the war, he joined the Hogarth Shipping Co. of Glasgow, and was their senior chief engineer by the time he left the firm. Between the wars he retired from the R.N.R. with the rank of Engineer Lieutenant-Commander.

In 1933 he was appointed marine engineer of the Portsmouth Division of the then Southern Railway, being responsible for all repairs and re-fits to their Isle of Wight Services fleet. He retired in 1955.

Mr. Traill, a member of the Institute since 1936, left a widow.