

EDUCATION OF THE DEAF

DURING the recent meeting of the British Association at Belfast, the session of the Education Section (L) on the morning of September 8 was devoted to three papers and a discussion on the education of the deaf. Mr. A. L. Binns, president of the Section, took the chair and there was a large attendance.

The first paper, by Sir Richard Paget, on "The Education of the Totally Deaf", was read in his absence by Mr. E. S. Greenaway, headmaster of the Yorkshire Residential School for the Deaf, Doncaster. Sir Richard put forward conclusions about the relationship between human speech and thought, the origins of speech and the possibilities of lip-reading. He reported that he and his collaborators had evolved a new language of manual signs. He recommended that this should be learned by the mothers of young children who were found to be totally deaf, and taught by them to their children, before speech.

In a second paper, Mr. R. Askew gave an account of the establishment, in 1946, of the first secondary grammar school for the deaf, the procedure adopted in selecting candidates for admission, usually at the age of 13+, the curriculum and out-of-school activities, the social life of the school, and the educational achievements and range of careers followed by its pupils.

Lastly, Prof. A. W. G. Ewing (University of Manchester) presented a summary of the results of investigations into the capacity of very young deaf children to learn and comprehend speech through lip-reading, into variations in the mental abilities, aural histories and residual capacity to hear of pupils in special schools for the deaf and partially deaf, the use of hearing aids and the ages at which children are ascertained to be deaf. Prof. Ewing illustrated his paper by a short documentary film "Children learning to Lipread". This showed how parents learn to train their children to watch for speech and to understand it through lip-reading, by engaging them, informally, in activities appropriate to their ages and interests.

Sir Richard Paget said that the mentality of uneducated children who are totally deaf is "utterly primitive". Handicapped by wordlessness, they can copy the actions of others and learn the techniques of various trades, but they cannot originate and cannot think logically, because "logical thinking depends upon the rearrangement of 'units of thought', such as our words: but the units of thought of the uneducated deaf are so vague, diffuse and shapeless that they cannot be fitted together with any precision". Their minds work differently from ours; they are probably a million years behind the times.

There is a very close relation, Sir Richard said, between expression by manual pantomime and expression by the tongue, lips and other oral gestures which carry the meaning of human speech. The noises of speech are quite secondary. They carry the gestures. Speech without sound is an effective means of expression, although intelligible only to a good lip-reader. The 'secondary' noises which accompany speech express the emotional state of the speaker. There is what Charles Darwin called "some kind of sympathy" between the movements of man's hands and those of his mouth. Originally, primitive man (with a mentality probably similar to that of present-day uneducated deaf mutes) must have expressed

his ideas by pantomime; but "without knowing it, his mouth mimicked his hands".

Oral methods of educating the deaf aim at making the deaf appear to be normal, for example, by good lip-reading, good articulation and a sufficient vocabulary to enable their pupils to carry on simple conversation. But speech and lip-reading are extremely difficult for all but the exceptionally gifted deaf. Successful lip-reading is dependent on good sight and a clear speaker. It is not practicable in large gatherings, such as at a cathedral service. Many of the claims that are made of the successful teaching of speech to the deaf have related to cases of residual hearing, or of deafness appearing after the deaf pupil has already learnt to speak. Only a relatively small percentage of the deaf is actually totally deaf.

Generalized pantomime, Sir Richard commented, is a blind alley, which ignores the use of words. The oralists have been right in condemning the use of natural sign language. With the collaboration of Prebendary Albert Smith, of the Royal Association in Aid of the Deaf and Dumb, and others, Sir Richard said he had evolved a "systematic sign language", in which each sign is the equivalent of a spoken word. He thought that if such a language were used in communicating with a young totally deaf child, as a hearing mother talks to her young deaf child, it is probable that this deaf child would pick up the signs as easily as a hearing child picks up words. In this way the deaf child might acquire a vocabulary of verbal signs which it would use at first in the place of spoken words. At present this vocabulary of the new sign language amounts to about 3,000 signs, of which 900 are designed for quite young children. The principal signs of the children's vocabulary have recently been filmed by the Wellcome Foundation. In 1948 Mr. Greenaway sent one of the oral teachers from his school to London to learn this children's vocabulary. She learned the 900 signs at the rate of 240 signs an hour. Her whole instruction period was only eight hours, and she demonstrated her knowledge by signing one of Edmond Dulac's Russian fairy stories, after going through it once with Sir Richard. A systematic sign language would be incomparably easier to acquire than any spoken language.

Mr. Greenaway said that he firmly believed the oral method of education to be basic for all deaf children. He is concerned about pupils who are taught orally, but unsuccessfully. He believed that research, in the use of hearing aids, for example, would open up many possibilities of better education for the deaf in the future. But "a deaf child who has failed at school has failed to live". Of twenty deaf boys and girls who had left his own school this year, one had gained admission to the Mary Hare Grammar School for the Deaf, three had attended courses of technical training outside the school for the deaf; before leaving, four others were certainly oral successes, and four more would probably be described as oral successes. He was concerned about the rest. He felt that for children like them something should be added to oralism.

In a short discussion which followed, it was suggested that signing, if encouraged in a school for the deaf, might become a substitute for ordinary language. Finger-spelling was suggested by one speaker as a chief method of education, and another speaker asked

if the introduction of a variety of methods would not create confusion in schools for the deaf.

Mr. R. Askew said that the Mary Hare Grammar School for the Deaf, which was first opened in 1946, with 44 pupils, now provides 75 places. It is wholly oral, like the two private schools for the deaf from which it took its roots and which it replaced as centres in which secondary education is available to the deaf. In describing the aims of the Mary Hare School, Mr. Askew quoted the late Sir Fred Clarke—"to liberate the intelligence of our pupils, in and through active membership of society"—in this case by the achievement of the pupils, although deaf, of capacity to participate in the hearing, talking society of the general community. To gain this, the pupils have to have confidence in their abilities, particularly their capacity to lip-read and in general knowledge, which they must be able to enrich by reading.

The procedure adopted for selecting candidates for admission is: (a) notification to local education authorities of the holding of an entrance examination, (b) a preliminary screening test, by written papers in English, general knowledge and arithmetic, taken by candidates in their schools, followed, in the cases of those who attained the required standard, by (c) a visit to the Mary Hare School, during which the history of each candidate is studied, in the light of reports from head teachers, tests to determine hearing loss, the results of performance tests of ability and a vocabulary test, and assessments of personal and social behaviour in which all members of the teaching staff participate. The mental testing is carried out with the collaboration of the Department of Education of the Deaf, University of Manchester. On admission, the pupils who were born deaf are from two to three years retarded in vocabulary.

Each school day begins with an assembly at which a hymn is sung, followed by half an hour during which speech training is provided to meet individual needs. Wearable hearing aids are used by many pupils. 'School subjects' are taken by specialist teachers. A weekly 'library period' is an important part of the curriculum of each form. Extra-curricular activities include community singing, free access to a studio for painting and drawing, athletics in which the pupils compete with those of schools and organizations for ordinary boys and girls, hobbies and pets, a pig club and a school magazine, managed by a committee of the pupils.

In 1949, of twelve candidates who sat for the School Certificate Examination, all were successful. Since that year a number of pupils have gained the General Certificate of Education (two at the higher level). This year two pupils are proceeding to universities, one with a State scholarship. Not all pupils are expected to take the General Certificate. The aim of a wider culture is more important. Former pupils follow a wide range of occupations; for example, one, an assistant in the pathological laboratory of a hospital, is now studying for a university degree, and another is a quantity surveyor. All are working happily side by side with ordinary people, who accept them as fellow-workers. Eleven former pupils are continuing their studies by correspondence courses.

The number of schools for the deaf in Britain presenting candidates for admission has grown from ten, in 1946, to twenty-six in 1952. The existence of the Mary Hare Grammar School appears to be an incentive to teachers of the deaf elsewhere, and their pupils, to aim at higher standards.

In answers to questions, Mr. Askew said that the Mary Hare School is staffed by seven fully qualified teachers of the deaf and two teachers who are working for a special qualification. Incentives are used to encourage pupils to rely solely on speech and lip-reading as a means of direct communication. The tendency of newcomers to resort to signs is "dying out".

Prof. Ewing's paper summarized developments in the educational treatment of deafness in children that have resulted from modern scientific research in Britain and the United States, and included references to investigations made in the Department of Education of the Deaf, University of Manchester, with financial support from the Medical Research Council and the Leverhulme Trustees. It has been found that the onset of dumbness, due to deafness, can be prevented in earliest infancy. Children of two years old have learnt to lip-read and begun to talk spontaneously, as a result of skilful training in their homes. This possibility was first discovered when the parents of a deaf girl, aged one year and two weeks, demonstrated that, under the guidance of Dr. I. R. Ewing, they had trained her to lip-read and respond by specific acts of behaviour to six different phrases spoken in a natural and conversational manner. She was one of more than thirty deaf children, whose ages ranged from twelve weeks to nearly three years, who had similar training during 1947. By the age of two and a half, some of them became able to understand, through lip-reading, a vocabulary of up to 500 words and phrases.

It has been shown that deafness can be effectively ascertained during even the earliest weeks of life. Special tests for this purpose, based on the results of a study of the ways in which ordinary children develop capacity to respond to sound, have been evolved.

Of 781 children referred by medical officers and otologists to the Department of Education for the Deaf, University of Manchester, during 1948-51, for tests and educational guidance, those of two years old form the largest age-group. A majority of the pupils who at present are admitted to schools or classes for the deaf or partially deaf have had their handicap since before the age of two years; but many cases of partial deafness and some of severe deafness are not ascertained until after the children's admission to ordinary schools.

Great variations have been found in the stages of linguistic development which have been reached by deaf and partially deaf children when first seen. Of 430 children referred before the age of five years, almost all used their voices purposefully and some, especially of those who had become deaf after the age of one year, had a certain amount of imperfect speech. Of 351 boys and girls of school age, a majority were already talking, although very often imperfectly. Fewer than five per cent of pupils in schools for the deaf are unable to hear any sound. Experiments have shown that hearing-aid equipment can be designed and constructed to enable children who are very severely deaf to hear speech to an extent that stimulates their linguistic development and facilitates their general education. Children who, without this equipment, cannot hear any sound of conversational speech, unless uttered within a distance of two inches from their ears, have learnt to combine skill in the use of hearing aids with proficiency in lip-reading. Investigations are in progress to find ways that are economically practicable for making school rooms

acoustically fit for the effective use of powerful hearing aids, and ways of modifying hearing aids to enable very young children who are severely deaf to benefit from continuous auditory experience.

During the course of a brief final discussion, Prof. Hallowell Davies, of Washington University, St. Louis, said that in the Central Institute for the Deaf, with which he is associated, it has been found that children who are admitted to the nursery unit, at an early age, are much less liable to linguistic retardation than those who enter school later. No 'signs' have ever been used in the Institute.

As a personal comment, the present writer regrets that the first paper at the meeting tended to focus attention on the use of 'signs' as a means of communication with the deaf, and to divert it from consideration of the outstanding success with which secondary education for the deaf has been established at the Mary Hare Grammar School, which is a unique institution of exceptional interest to educators and psychologists. A dictionary of organized signs, prepared by the Abbé Sicard, who published in 1823, still exists; its use was long attempted in France but was abandoned many years ago.

MEASUREMENT AND IMPORTANCE OF ELASTIC PROPERTIES OF METALS

A CONFERENCE was held at the National Physical Laboratory, Teddington, during March 20-21 on the "Measurement and Importance of the Elastic Properties of Metals", to discuss the measurements of elastic constants which have been going on in the Laboratory and elsewhere, and to consider how the information obtained from them could be used by metallurgists. It was attended by between eighty and ninety representatives from universities, industrial concerns and government departments. The first day was devoted mainly to describing experimental techniques and the results which have been obtained from them, while on the second day the speakers considered how elastic constant measurements could contribute to new knowledge of the physics of solid states.

The first paper was by Mr. A. F. C. Brown (National Physical Laboratory), on the "Static Measurement of Very Small Strains". He pointed out that in order to measure strain to an accuracy of ± 1 per cent it is often necessary to measure changes of length of less than 10^{-6} in. Even higher precision is needed if a study is being made of small variations in elastic constants, and great difficulty is experienced in transferring the strain to the extensometer without introducing significant errors. Generally, the most suitable methods are those in which the extension of a standard length of a specimen is made to rotate a mirror; but direct microscopic examination of length changes, and interferometer techniques, have also been used. It is very important to ensure that the desired type of loading is achieved, and this has been the subject of considerable research in the National Physical Laboratory.

In a paper on "Medium and High Frequency Measurements of Elasticity", Mr. G. Bradfield (National Physical Laboratory) described the methods in use at Teddington for the dynamic measurement of

elastic constants, pointing out that, except at very high frequencies, the moduli vary somewhat with rate of straining. This was illustrated by results with polycrystalline aluminium from 0.4 c./s. to 50 kc./s. over a temperature range of 30°-700° K.

Methods using pulse-travel times and frequencies of 1-20 Mc./s. are very useful for measuring elastic constants of single crystals, and accuracies of a fraction of 1 per cent have been obtained with crystals of a few millimetres in size. On fine-grain polycrystalline bars about 10 cm. long, accuracies of 0.03 per cent are possible. Generally, the quartz crystal transducers used are mounted on steel or fused quartz blocks, which are applied to the specimen under test. Although separate transducers for transmitting and receiving have been most widely used at the National Physical Laboratory, many measurements with a single probe on both solid and liquid specimens have been made at high temperatures, and an attempt is being made to reach 1,550° C. in this way.

Of many alternative resonance methods, those using magnetostrictive transducers (which can produce both rotational and irrotational vibrations) are preferred, and have been used from near absolute zero to 500° C.; 1,000° C. is the probable limit with the present equipment. Inductor methods have been used for specimens weighing as little as $\frac{1}{4}$ gm. The best accuracy obtained by resonance techniques is a few parts in 10^4 in the elastic moduli.

For bars, the lateral inertia effect on velocity enables Poisson's ratio to be determined very accurately, and deviation from $(\frac{1}{2}E/G - 1)$ indicates anisotropy quantitatively, and thence the true constants for an isotropic material can be calculated, as described in the following paper.

Mr. H. Pursey and Mr. T. H. Schofield (National Physical Laboratory, Physics Division and Metallurgy Division, respectively) presented a paper on "Elastic Constant Measurements on Some Alloys". Measurements of the elastic moduli of a series of α -solid solutions of copper with elements of the first long period show principally a fall in modulus as the percentage of stranger atoms increases, and for a given atomic percentage of solute the higher the number of valency electrons the greater the depression in elastic moduli. They pointed out, nevertheless, that plotting elastic moduli against electron concentration does not bring the four curves together, and it is clear that they cannot be brought together by plotting against any power of electron concentration. Zener's theory of the misfit effect between solute and solvent atoms was outlined, but this too fails to explain the results satisfactorily. A further anomaly exists at very low atomic percentages, where it is found that the effect of introducing small amounts of stranger atoms is, in fact, to raise the moduli above those obtained for the pure metal. This may be due to the tendency of the foreign atoms to provide 'anchor points' for dislocations, thereby strengthening the material.

The remainder of the paper was devoted to an explanation of the mathematical technique whereby the elastic constants of an isotropic material may be derived from measurements on an anisotropic specimen of the same composition, assuming the anisotropy to be due to preferential orientation of grains, and that the lattice has cubic symmetry. The corrections are functions of the single-crystal constants, and proportional to the fractional difference between $(\frac{1}{2}E/G - 1)$ and Poisson's ratio as determined from the lateral inertia effect on longitudinal vibrations.