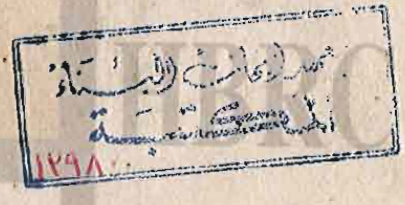
STUDY

4

THE DESIGN OF PHYSICS LABORATORIES FOR ASIAN SECOND LEVEL SCHOOLS



ASIAN REGIONAL INSTITUTE FOR
SCHOOL BUILDING RESEARCH
Sponsored by Unesco
COLOMBO
1968

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STUDY no. 4

THE DESIGN OF PHYSICS LABORATORIES FOR ASIAN SECOND LEVEL SCHOOLS

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COLOMBO
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Prepared and Published by The Asian Regional Institute for School Building Research, P.O.Box 1368, COLOMBO, Ceylon. 2000 copies

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** *In preparation, for later 1968 publication.*

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Annual report, 1967

Information bulletin, 1967

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PREFACE

Great changes are currently taking place in the teaching of science to secondary school children. The emphasis is moving from teacher-centric activity involving student verification of principles explained in lectures, to pupil-centric work in which, through guided experiments, the children endeavour to find out for themselves and in their own way the principles or laws relating to the particular topic they are studying. Demonstration *follows*, rather than *precedes*, experimental work and *ad hoc* group discussion replaces formal lecturing. Every science lesson now needs to be held in the laboratory, for in one period the activity may change from student experiment, to discussion, to teacher demonstration, back to experiment and finally, recapitulation, perhaps by filmstrip or brief talk.

These changes will inevitably be reflected in the nature of the building accommodation and furniture that is provided for the new science teaching. It is important, for example, that new laboratories be designed not only to house laboratory benches but also to provide space for discussions; initiatives that are encouraged in the student by the new teaching methods demand movable rather than fixed furniture; facilities are required for group project work and the need for display and visual aid areas is much greater than was the case in the past.

This publication endeavours to provide information on the functions, furnishing and design of spaces for physics teaching in lower and higher secondary schools. It has been framed in a regional context with physics syllabuses of the Asian Region in mind but variations to the suggestions made will sometimes be necessary depending on local conditions. For example, the furniture shewn is intended for construction in timber because it is the most readily obtainable and cheapest material available in most countries of the Region. Some States in which steel is cheap, may prefer to use light sections. Apart from considerations such as these, the general principles outlined by the Consultant Educationist who has participated in the preparation of this document will be found valid in all countries.

The study has been approached in four stages. In the first stage the situation as it affects physics teaching in the Region was studied together with sizes of teaching groups and age ranges of second level children in the countries of the Region. The changes in teaching method that are taking place in the Asian Region in the field of Physics were identified. Standards of accommodation, where they exist, were examined.

The first stage was followed by a systematic study of activities in the physics laboratory made by the Architect in collaboration with the Consultant, a specialist in this field, who outlined the various teaching requirements, the material to be

taught and the changes in teaching method currently taking place. From this study, furniture was developed and a prototype of a movable student bench produced in the Institute's workshop. Finally, the space required in the laboratory was quantified.

The drawings of laboratory layouts shewn at the end of this paper were originally produced as models before reduction to the two dimensional form.

The background to the production of this paper is the urgent need for a ready reference to the design of physics laboratories in the Asian Region. In some countries where architectural services are not available the situation is difficult, for not only is it impossible for those responsible for design to translate educational requirements into useful and economical building accommodation, but also frequently they do not realise the need for the dialogue between the educator and the designer that is an essential prerequisite to good school building.

Even where an architect's services are available, then there is often insufficient time for the protracted discussions with physics specialists that are so vital to laboratory design. This paper may assist in providing some useful background material in this context.

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SUMMARY

There is a change in emphasis in the new physics teaching methods in the Asian Region from teacher-centric to pupil-centric teaching. Future laboratories will need to be designed to provide facilities for student experiments, discussion, demonstrations, students' project work and greater use of visual aid materials. This involves bringing the classroom into the laboratory and abandoning the separate physics lecture rooms; it requires easily movable student work benches at which the children, through guided experiments can find out for themselves and in their own way, the principles relating to the particular topics they are studying.

These principles have led to the design of essential furniture to facilitate the practice of modern teaching methods in an environment which ensures reasonable illumination and thermal comfort for the children. Emphasis is given to the correct sizing of furniture in relation to body sizes of Asian secondary school children.

Designs suitable for use in either hot-humid or hot-dry (or cold) climates are given for laboratories for teaching groups of 20 and 40 children.

It is concluded that the per place requirements for laboratories are between 3.4 and 3.8m^2 and for smaller l of 20 places, 4.5m^2. These areas include storage space, space and dark room. This is a more economical use of s is presently the case in some Asian countries in which t is used together with a lecture room, the combined area may exceed 5m^2 per place.