

# Manual Instruction in Secondary Schools for Boys

## Introduction

1. This Circular is issued for the assistance of Governing Bodies and Masters in arranging the course of Manual Instruction in Boys' Secondary Schools. The subject in its broader aspects has been so fully covered in the Report of the Consultative Committee on Practical Work in Secondary Schools\* that the Board have purposely confined this Circular in the main to suggestions on various types of equipment and methods of instruction which have been found by experience to be useful. On such points as the educational value of manual work as part of the normal Secondary School curriculum, its particular value for certain types of boy, and the need for a substantial and comprehensive course of instruction under the supervision of a regular member of the School staff, it will suffice to refer to the Consultative Committee's Report.

2. As regards the position of the subject in the school curriculum, the Board have not laid down any definite requirements under Article 8 of the Secondary School Regulations, and they desire to leave a large discretion to the schools in this matter. In general, the Board contemplates that all boys during some period of their Secondary School career should receive systematic Manual Instruction; that, as a rule, the course should extend at least up to the age of 14; that in many schools it can profitably be continued for all boys up to 16; and that in all schools there should be facilities for continuing Manual Instruction as a voluntary subject, or as a special subject for particular boys, up to the time of leaving the school.

## Workshops

3. A workshop, properly fitted and equipped, is essential for all the more serious forms of handwork which are suitable for boys of 12 years old and over. Almost any large room that is fully lighted and sufficiently warmed and ventilated may be used for the purpose, but the closer it approximates to the type of an ordinary workshop, the better. It should be large enough to permit freedom of movement. A wooden floor is preferable to a concrete one, both as more comfortable and as involving less risk of injury to the tools. The fittings should as a rule be as simple as possible. The working benches should be rigid and not all of the same height. There should be a grind-stone, a sink with water supply, and provision for heating glue, soldering-irons, etc. There should also be a light engineering foot-lathe. In schools where there is no special room for Metalwork, provision should be made for a certain amount of metalwork to be done in the woodwork room. This need only involve the fixing, in a suitable position, of a strong rough bench, with one or more smith's vices. There should in all cases be a small reference library of workshop books.

\* The editor felt that readers would be interested in this historical document first published in 1915. It is here reproduced in its original text.

4. In large schools where there is a definitely organised course of metalwork extending over one or more years, a second workshop, specially fitted for the purpose, is needed. As regards space, flooring, lighting, warming and ventilation, the same remarks apply as to the woodwork room, but for forge-work an annexe with a fire-proof floor is desirable. If power is available, fans rather than bellows should be used for the forge fires. Anvils and swage blocks should be fixed conveniently near the forge, but ample room must be allowed for the use of the sledge-hammer. Smith's vices should always be fixed on strong benches placed in a good light. Suitable screens or guards must be provided for all running machinery. The kind of machinery necessary will depend upon the aim of the work. If the intention is to lead on to a definite engineering course, various types of machines, run by power, are desirable. In other cases, little machinery beyond the lathe is needed.

5. In small schools, where the provision of a separate, metalwork shop is not possible, a forge may usefully be placed in a small annexe to the woodwork room.

## Courses of Instruction

6. The following paragraphs contain suggestions for the kind of Manual Work that is suitable respectively for the Junior School (boys below the age of 12) and for the main portion of the school (boys between 12 and 16). The suggestions made do not profess to be exhaustive, nor is it intended that they should prescribe exactly the lines of work which a school should follow. Any well-planned course of progressive Manual Instruction will give effect to the general principles here laid down may be submitted for approval.

### (A) *The Junior School*

7. For pupils below 12 the provision of Manual Work should be abundant; usually it is meagre and wholly insufficient. Little boys like lessons in which they have to use their fingers. Handwork is thus an easy means of stimulating their interest and increasing their general alertness.

8. The purpose of Handwork at this stage is three-fold: to satisfy the children's natural love of construction, to provide concrete modes of illustration and expression often more natural to young children than words, and to enable the fingers gradually to acquire skill and dexterity in as many ways as possible. Hence the exercises should be both simple and varied. They lose their usefulness if they become elaborate, while interest



is rapidly diminished by monotonous repetition. The earlier work may be incidental and connected with other subjects, but caution is needed against the excessive use of Handwork for purposes of illustration. Even in Junior classes time may very easily be wasted in modelling perfect illustrations of objects which a child will understand in a moment from a good picture.

9. In the earlier stages the Handwork will grow naturally out of the activities in the Kindergarten or Infants' School. It may include such forms as paper-cutting, cardboard modelling, string-work (for instance, netting and knotting), basketry (including raffia and cane weaving and basket making), plastic modelling, simple bookbinding, work in leather and other similar materials; and as the boys grow older and stronger, the simpler and lighter forms of wood and metal work. Every effort should be made to awaken the inventive powers of the boys, but the teacher must always guide the work and see that it is properly graded, with increasing attention to accuracy. By the time a boy reaches the age of 12, he should be familiar with the simpler uses of the commoner tools, mainly those of the carpenter's shop.

(B) *The Main Portion of the School*

10. In most schools there should be a definite course of workshop practice from the age of 12 to at least the age of 14, taken in weekly periods long enough to provide adequate time for work at the bench and for the associated instruction and drawing. A period for manual work should be, as a rule, from one and a half to two hours.

11. As a rule, wood is the chief medium employed for the formal instruction in the use of tools between the ages of 12 and 14. It need not, however, be the only medium, and it is becoming increasingly common to find even younger boys constructing objects which involve the use of metal as well. Where the course extends beyond the age of 14, it should certainly include work of this character, leading in subsequent years to work at the forge, bench, and lathe.

12. In arranging the course of work in this part of the school, it is important to give full weight to the previous training and experience of the individual boys in each class. For instance, an increasing proportion of the boys who enter the Secondary school at about the age of 12 have had workshop practice in the Elementary School extending over at least one year, and have attained a standard of craftsmanship in advance of other members of the class. This is sometimes lost sight of, with a consequent regrettable marking of time on the part of such boys. In every class, moreover, boys will vary greatly in manual skill, ingenuity and resourcefulness, and their instruction will have to be varied accordingly.

13. Whether for the individual boy, for a group of boys, or for a whole class, the course of work in wood and metal should be based on an orderly sequence of processes, the appropriate tools being

introduced as required. As a rule, any new piece of work should include some one new difficulty; for example, the use of a new tool, or the use of a familiar tool in a new way. Definite instruction in the use of every new tool, and less formal instruction on materials used, are always necessary, and a clear explanation, usually accompanied by a practical demonstration, should be given of every new bench operation involving difficulty.

14. Some teachers adopt a rigid scheme of work consisting of 'exercises' and 'models', drawn up on a definite plan with difficulties carefully graded and principles in logical sequence. Clear and definite instructions are provided at every step, and every pupil is required to follow these instructions precisely. In some ways the plan works well. At the end of the course certain definite aims are achieved; the pupil has learnt exactly how to use certain tools and to perform certain operations; all pupils have made the same things, and the periodical comparison of their models often leads to healthy competition.

15. The weakness of such a plan lies in the small demand made upon the intellectual and inventive powers of the pupils. Virtually all the thinking is done by the teacher, and the boys do little more than carry out his precise directions. Many teachers, realising this, have adopted the alternative plan of allowing their pupils to suggest the common objects to be made. They find it quite possible still to retain a satisfactory sequence, while giving freer play to the pupils' individuality. Collective instruction has thus in considerable measure given place to individual effort. This plan has obvious advantages. It makes it easier for a boy joining the class for the first time to take up the work at the point where he left off at his previous school; it enables the teacher to make effective provision for boys of varying capacity; and above all, it makes it necessary for the boy to think, since he is not engaged in a merely mechanical operation.

16. Success in this newer plan calls for much resource and skill on the part of the teacher. In the earlier stages definite instruction is indispensable, for until a boy has acquired a working knowledge of the ordinary tools and some skill in their use, he cannot be thrown on his own resources. The ordinary boy will rarely find out for himself how, for example, to set a plane-iron or to cut a mortise properly; he must be taught. And even after considerable experience, he is constantly in need of advice over his bench work. The following are a few actually observed instances of successful co-operation between teacher and pupils:—

(a) A particular class of boys had learnt how to 'square up' rectangular blocks of wood. The teacher showed them how to screw pieces of wood together, and gave them a few minutes' practice with the screwdriver. He then showed them a bench-hook, reminded them of its special use, and discussed the principles underlying its construction and the usual limits of its size. The boys were then told to bring, a week later, working drawings of a bench-hook of their own design. Many of the drawings



were acceptable; a few needed modification. After a general discussion the boys set to work and made their own bench-hooks. They naturally felt that they were doing original work, and to a limited extent they were, but the teacher's large share in the general plan is obvious.

(b) A particular lesson was on 'stop-chamfering'. At an earlier stage of the work, some months previously, the boys had made a simple wall bracket, to include chamfering and stop-chamfering, and, if possible, certain other principles of construction recently learnt. By the next lesson some excellent designs had been prepared. Eleven out of 18 were acceptable, and the boys set to work upon them. The other seven were poor, and in the end the teacher collected the seven boys round the blackboard and helped them to work out a design of the sort of bracket required.

(c) 'Dovetailed halving' was the subject of a lesson, the instruction being definite and detailed throughout. The teacher then showed the boys a model of a newspaper rack, and called for working drawings, for a rack of original design, but on the same general lines as the one shown, to be brought in the next week. Dovetailed halving joints alone were to be used for joining the stiles to the baseboard, while the stiles and the rails were to be united by half-lap joints. In this case, only four of 20 designs were acceptable, and the four boys responsible for these were each told to select four other boys from the class and to parcel out amongst them the various operations involved in the making of the respective racks. The results were excellent.

(d) A mitred angle-bridle joint was the subject of a lesson and the boys were told to make picture frames, the sizes and designs being left entirely to the boys themselves. In this case collective instruction and criticism were obviously possible, since the same type of work was proceeding throughout the class.

(e) In an advanced class, strong framing was the subject of a lesson, and the teacher gave a demonstration on the construction of a wedged mortise and tenon joint. The boys were told to bring in sketches for common objects or structures in which strong framing was necessary. Of the sketches brought in, which were of a very varied nature, two were excellent; a few others were adopted after modification; the majority were too ambitious and beyond the range of school work.

(f) At one school a supply of partly and completely finished common objects is kept in stock, all designed for clearly showing different principles of construction. When a boy is considered to have acquired sufficient skill in the use of the ordinary tools, he is instructed to study carefully one of these objects, and then to make practical suggestions for a new model involving the same principles of construction. With accumulated experience of this kind, the ablest boys soon come to do valuable original work. They are thus made to learn and to do as much as they can for themselves,

and from quite an early stage to depend as little as possible upon the teacher.

17. These instances show what kind of expedient are resorted to by teachers who try to throw the boys on their own resources as far as possible, while reserving to themselves the general control necessary for the proper development of the course. It is one of the teacher's greatest difficulties to decide precisely how much help a boy requires. To give him more help than this is to reduce the value of his work; to give him less is not only discouraging, but may be even harmful. As knowledge and skill are acquired it is possible for the teacher to withdraw his help by degrees; the boy is thrown increasingly on his own resources to develop his own ideas. Advanced boys may be left very largely to themselves, the teacher merely giving counsel and criticism. At every stage a boy's own suggestions should be welcomed.

18. Importance should be attached, not only to principles and methods, but also to craftsmanship. A degree of accuracy suitable to the material and to the development of the pupil should always be extracted. Increase of accuracy should be demanded with increase of experience, and the standard should bear some relation to the length of the course. Too great a degree of accuracy is, however, sometimes demanded in the earlier stages.

19. The course in woodwork should include the construction and use of the simpler joints employed by carpenters. This work, though only of a subordinate character, since it is merely a means to an end, is important, and needs very definite teaching. There is, of course, no point in teaching the construction of a joint unless and until the joint is to be actually used in constructive work. The more elaborate joints are out of place; they are for the most part difficult and rarely needed for work done in school. The type of object or model made will naturally vary with the locality. Thus, in rural districts, the objects may properly be taken from the farm or garden; the more advanced boys might, for instance, make an egg-box, a pigeon loft, a hen-coop, a simple dog kennel, a garden gate, a roof-truss, a model of a simple farm implement, and even a wheelbarrow. The subsequent iron-work might include a hasp and staple, different kinds of hooks, lynch-pins, gate hinges, etc., and the boys might even shut and put on a wheelbarrow tire, and make stays and bolts of different kinds. In practical life most of the work done with tools at home is concerned with mending and repairing, and, whenever possible, a school course should include work of this type.

20. In the earlier stages of all courses, rectilinear work of different kinds should be predominant, but curved work should be introduced gradually. Such tools as the gouge, box-saw and spoke-shave call for considerable skill, and work involving their use has the further advantage of adding new features of interest to the associated drawing. Incidentally it may be mentioned that the common objects made



are sometimes too small and of very little practical use. Utility is apparently overlooked.

21. Experience shows that a reasonably satisfactory course of this kind can be covered in the two years between the ages of 12 and 14. In schools where the Manual Instruction cannot be carried further, care should be taken not only to make the course, as far as possible, complete in itself, but also to make sure that it is associated with the special interests of the boys in practical life. Boys with a special bent should always be encouraged. As already suggested, a certain amount of introductory metalwork may well be included even in a two-years' course. So also may the construction of simple forms of apparatus or working models.

22. In schools where the course extends over a third year, a definitely planned scheme of metalwork ought to be provided, though no doubt this work will often have to be done at a special bench in the woodwork shop, and to some extent, perhaps, in the annexe containing the forge. The earlier metalwork may, as a rule, begin with tinplate, zinc, aluminium, and thin brass or copper, iron usually coming rather later. If lead is employed, the pupils should be reminded of the poisonous nature of lead compounds. At this stage, most if not all of the work will be done at the bench, the principal tools used being the pliers, the shears, the hammer, the punch and the file. The cold chisel may also be used if small anvils or iron blocks are available. Bent iron-work and flat sheet metalwork may with advantage be taken first, moulded sheet metalwork taking a less important place. After soldering has been taught, it will be possible to introduce the construction, in sheet metal, of many simple objects of the kind made by zincworkers and tinsmiths. If there is a suitable annexe to the woodwork shop, a few simple forging operations may also be included; where there is no special shop it will not be possible to carry the course much further, and the work done will necessarily be restricted in character and on a small scale.

23. Where a separate shop is provided, there is scope for a much fuller course of metalwork. The bench work itself can be carried much further, but heavy bench work and (as in woodwork) practice for its own sake are to be deprecated. There is no point in making boys file up such things as iron cubes and rectangular iron blocks for the sake of practice with the file, though at a later stage the rather difficult operation of filing up hexagonal nuts may perhaps be given to the more expert boys. Screw cutting with the stocks and dies, and drilling and riveting, are important operations, and can be taken comparatively early. Simple forging operations, for instance drawing down, upsetting, scarfing, and simple welding, are useful and interesting, and quite within the capacity of boys of 15 or 16 years of age. On the other hand, the making of smith's joints (except simple cases of welding and riveting), and plumber's and coppersmith's joints (except simple cases of soldering and brazing) are for the most

part out of place in a school course. The necessity for fostering the boys' special interests should be borne in mind. The construction of a good deal of apparatus, for example electroscopes and galvanometers, may with advantage be included in a three years' course, and may well be substituted for some of the more difficult formal operations at the bench and the forge.

24. In schools where the course extends over four years, a separate metalwork shop is almost indispensable, and the work of the third year may now be elaborated and extended to operations of increasing difficulty. The greater portion of the fourth year, however, should be given up to applied metalwork (for instance, to such examples of ornamental ironwork as the reproduction of carefully selected antique hinges); to such operations as welding, case-hardening, and tempering; and to the construction of mechanical and physical apparatus for use in the school laboratories, or for the boys' own use in their leisure hours. In those few schools where the course extends over five or six years, a very considerable amount of technical skill can be acquired in the working of both wood and metal, and a fair proportion of the available time during the last year or two ought to be given up to applying that skill to useful and ornamental work of a reasonably advanced type. But, as already stated, boys with special practical interests should be encouraged at every stage, and should be given every opportunity for carrying out original ideas. If, for example, they need special castings for particular models, such castings can be purchased cheaply; and occasionally a boy may be encouraged to make his own patterns and get them cast at a local foundry.

25. It is often an excellent thing to arrange for the co-operation of several of the more advanced boys, or even of the whole of an upper class, in doing a larger piece of work. Such objects as a set of bookshelves for the school library or a cabinet for the museum can be made in this way. In several schools work on an even larger scale has been undertaken successfully, such as the designing and construction of a pavilion or swimming bath. In one case where a school pavilion was constructed, two or three of the senior boys had read a small book on building construction, and had acquired a general knowledge of framing, of roof-structure, of floor-structures, and so on; and having discussed with the teacher the general principles involved, they organised the work in such a way that a whole form were kept busy during their spare time for more than a whole term. The value of this kind of work is greatly increased when the organisation and control are undertaken by the boys themselves, and the teacher acts only in a consultative capacity.

#### Use of Machinery and Care of Tools

26. Hand-tools are the first essential in school work, but at the proper stage, when experience shows that the limitations of a particular hand-tool have been reached, the machinery may be



introduced. Over-elaboration in machinery is undesirable, but all machines should conform to patterns in actual workshop use. Boys who intend to go on to engineering should be encouraged to study and use all the machines available.

27. The course of Manual Work should in all cases include instruction in the care of tools. Boys working in wood should learn how to set and sharpen their tools; they should begin with the oil-stone, and, as they become stronger, go on to the grindstone. They should also learn from practical experience something about the different kinds of timber in ordinary use, and about the properties of metals. In the smith's shop, by the time a boy reaches his fourth year he ought to be able to sharpen, temper, and re-head a cold chisel, and to repair the simpler makes of tongs and common forge tools. He should also be encouraged to try to make for himself a few tools of the more easily constructed kind. For particular operations, smith's tools of standard make have sometimes to be slightly modified, an operation which an advanced boy may occasionally be able to carry out.

#### Drawing

28. Drawing should be associated with wood and metal work, and the boys should be taught to make scale drawings and to work from them. In the earlier stages a preliminary drawing to scale should be the rule, but when the boys have attained a good standard of draughtsmanship it will not always be necessary to insist on accurate scale drawings, and a dimensioned hand-sketch may sometimes be accepted instead. In some cases a completed object may be given to copy, and the dimensions taken direct from the object. With certain types of work, on the other hand, accurate working drawings are always essential, and plans elevations, and one or more sections should be duly prepared. Isometrical project is sometimes useful, but in practice it is too often an additional exercise of which no further use is made. After the preliminary stages are passed it is often a good working rule to inquire what the skilled workman would do in similar circumstances; for instance, if he were making a rough nail-box, with the slides nailed together, he would not make a drawing at all, he would merely make a note of the dimensions and of the thickness of the wood; if he were making a set of bookshelves to given dimensions, he would probably make a working sketch; if he were making a cabinet involving first class workmanship, or an engineer's template, he would consider an accurate scale-drawing indispensable. It is excellent practice for the more advanced boys to make a dimensioned sketch of a machine and then to work out from it a series of accurate engineering drawings. The ability to read such drawings requires much practice, and is becoming increasingly important in many branches of professional work; in all branches of engineering it is essential.

#### The Boy and the Workshop

29. Manual instruction should not be regarded as an isolated subject of the curriculum, but should aim at definite association with such subjects as Science, Mathematics, Geography and Art. The workshop should, in fact, be looked upon not only as a place where formal lessons are regularly given, but also as a place where a boy may carry out any constructive ideas in connection with problems arising out of his school or home life. This is particularly important in the case of those schools where, for one reason or another, the formal course of Manual Work ceases about the age of 14 and out-of-school workshop meetings no less than clubs for encouraging other special interests are therefore to be commended. The ordinary boy is full of constructive curiosity which only needs to be carefully stimulated, and it is surprising how much knowledge he will acquire if he is intelligently left alone in the workshop.

*Complete Service to the Craft Potter*

WHITE CHINA SUPPLIES

**MAGPIES  
NEST**

144 KNUTSFORD ROAD  
WILMSLOW

Phone: Alderley Edge 582087

PAULINE BLYTHE,  
CRAFT ADVISER

CHINA PAINTS MEDIUMS  
BRUSHES KILNS

Postal Service