

CHAPTER XX.

SCHOOL GARDENS.¹

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Contents.—Historical Review—Sites and arrangement of School gardens—Different Sections of School gardens—Management—Instruction in School gardens—Educational and Economic Significance of School gardens.

I. HISTORY.

School gardens, in the narrow sense of the term, are a very modern institution; but when considered as including all gardens serving the purpose of instruction, the expression of Ben Akiba may be indorsed, "there is nothing new under the sun," for in a comprehensive sense, school gardens cease to be a modern institution. History teaches that the great Persian King Cyrus the Elder (559-529 B. C.) laid out the first school gardens in Persia, in which the sons of noblemen were instructed in horticulture. King Solomon (1015 B. C.) likewise possessed extensive gardens in which all kinds of plants were kept, probably for purposes of instruction as well as ornament, "from the cedar tree that is in Lebanon even unto the hyssop that springeth out of the wall."

The botanical gardens of Italian and other universities belong to school gardens in the broader acceptance of the term. The first to establish a garden of this kind was Gaspar de Gabriel, a wealthy Italian nobleman, who, in 1525 A. D., laid out the first one in Tuscany. Many Italian cities, Venice, Milan, and Naples followed this example. Pope Pius V (1566-1572) established one in Bologna, and Duke Francis of Tuscany (1574-1584) one in Florence. At that time, almost every important city in Italy possessed its botanical garden. The renowned educator Amos Comenius (1592-1671), in his *Didactica Magna*, maintains "that a garden should be connected with every school, where children at times can leisurely gaze on trees, flowers, and herbs, and be taught to enjoy them." In Germany, August Hermann Francke established a school garden at Halle, in 1695, in connection with his orphan asylum. The orphans were occupied with garden work during their leisure. In France, J. J. Rousseau (1712-1778) advanced the school garden idea in his "*Émile*," published in 1762, in which he pointed out the importance of garden work as an educational factor.

The philanthropists Basedow, Campe, and Salzmann likewise included school gardens among educational agencies. Campe, together with his wards, planted in the neighborhood of 10,000 trees during his lifetime. Salzmann wrote concerning this subject: "School gardens have been laid out neither to draw the attention of passers-by, nor to give great returns, but to instruct." Pestalozzi himself (1746-1827) was a farmer for a long time, and occupied his wards at Neuhof with field and garden work. "I wish," he said, "to make my estate the central point of my agricultural

¹ Articles on this subject were printed in the Annual Report of 1889-90, vol. 1, p. 308; of 1897-98, vol. 1, p. 225, also in volume 2 of same Report, p. 1623 and p. 1632. The following article is translated from Rein's Pedagogical Cyclopedia.

and educational efforts. The orphans are to be kept, and to be instructed at work and through work." The school garden idea was further advanced by Fröbel, who founded the first kindergarten at Blankenburg in Thuringia in 1840, and recommended light gardening for the larger children in connection with the play of the younger ones. Besides kindergartens, the first school gardens were established in the larger German cities at this time. In 1848 one was connected with the advanced school for girls in Worms. Dr. V. Stoy, in Jena, possessed a garden connected with his educational institution, from 1855, that was of the greatest use to him for instruction.

With regard to schools in general, however, these isolated attempts are of little significance, since they affected only private and secondary schools. School gardens entered upon a new stage of development when their establishment, in connection with rural elementary schools especially, was required by law. This first occurred in Austria. The Austrian imperial school law of March 14, 1869, prescribes in section 63 that "where practicable, a garden and a place for agricultural experiments shall be established at every rural school." A supplementary regulation, dated August 20, 1870, furthermore requires that instruction in natural history shall be given in an appropriately arranged school garden. At the Vienna exposition, in 1873, a schoolhouse with a perfectly equipped garden was exhibited. This not only gave expression to the new idea, but stimulated further progress. Prof. Erasmus Schwab may be considered the actual founder of elementary school gardens in Austria, although a few such gardens existed before his time; as, for instance, that of Neunkirchen, laid out as early as 1700. Others deserving of merit in their efforts in behalf of developing the school garden idea are: Prof. Alex. Mell, of Marburg; Dr. Francis Langauer, of Vienna, teacher and editor of "The School Garden" (1885-1891); Francis Susnick, of Vienna, teacher; Frederick Staudinger, of Gratz, teacher. In Austria-Hungary, the classical land of school gardens, there are at present (1898) over 18,000, covering an area of thousands of acres. Most of them are found in the crownlands of Bohemia¹ (4,500), Moravia (2,000), Lower Austria (1,000), Styria (800), Corinthia (300), Silesia (500). The idea is best exemplified in Styria, where there is no school without a garden. The Horticultural Society of Styria, under the presidency of Rector Kristof, deserves special credit for establishing and developing school gardens, which it has always been ready to support. It distributes annually, free of charge, a large supply of cuttings, all kinds of seeds, special varieties of flower and vegetable seeds, and the like. At the exposition held in Gratz in 1880 it exhibited a complete school garden, which received general approval and contributed much toward the spread of this useful institution.

The school garden question has also been alive in Switzerland for about twenty years. The government of the canton Thurgovia first recommended the establishment of model school gardens in 1879. Its example was followed by most of the other cantons, and since June 27, 1884, the Federal Government has taken up the question of school gardens, appropriating a yearly sum of 3,500 francs for their establishment. The agricultural society of Switzerland has recommended such establishments since 1881, and given them powerful support. By awarding prizes and other financial aid, it advanced the cause to an unusually great extent. Model school gardens exist now at the normal schools of Schwyz, Berne, Küsnacht, Zürich, and Chur, and at different elementary schools, as, for instance, in Lichtensteig, Hug, Flamatt, Buchs, Langenau, Lübingen, Zürich, and Berne.

Since the war of 1870-71 France has reorganized, improved, and developed its school system in many ways, supplying deficiencies. Besides improving the education of teachers, the law of March 18, 1882, outlined a course of study for primary

¹ It is reasonable to see a causal nexus between the enormous fruit crops and exports from Bohemia and the school gardens in that country.

schools that places the first instruction in horticulture and agriculture in the school gardens in the middle grades, where pupils acquire the knowledge of kinds of soil, fertilization, and field work. In the higher grades they learn farming, agricultural book keeping, and horticulture. A decree of December 24, 1885, requires that instruction on these subjects be not limited to theory, but be combined with experiments in the school garden. According to another decree of December 11, 1887, no plan of a school building in the country to which the State contributes shall be accepted, unless a garden be attached. Model school gardens are found at several normal schools, as, for instance, at Besançon, Nancy, Limoges, Rennes, Toulon, and Lyons. After the course of study has been completed, many French normal schools send their students to agricultural schools to acquire the practical training in agriculture and horticulture that will fit them for rural schools.

In Belgium the study of horticulture is compulsory. For practical purposes the school law of August 14, 1873, requires that each school shall have a garden of at least $39\frac{1}{2}$ square rods, to be used in connection with instruction in botany, horticulture, and agriculture. A royal decree of January 9, 1897, lays especial stress on vegetable culture, in which female teachers must be sufficiently versed to give theoretical and practical instruction. All public elementary schools in Belgium have gardens; the Government grants 6,000 francs annually as prizes among pupils who have excelled in this department of study.

Naturally the English, with their leaning to the practical, attach great importance to manual labor and agriculture. However, the State government bestows little attention on these things, especially after the pupils have passed the school age (14 years). Private societies receive support from the State for the further instruction of those who have left school. These societies establish so-called continuation or supplementary schools, not only for commercial and industrial but also for agricultural education. Since 1892 some gardens have been laid out in connection with agricultural schools, which serve for theoretical and practical instruction. Besides being present at lessons, the pupils are put in charge of special beds. During the summer their efforts are examined at different times by a commission, and prizes are awarded for the best work. Teachers equip themselves for this department of study by attending lectures that are given free by agricultural societies.

In Sweden an interest in school gardens has been manifested for many years, nearly as early as in Austria. A royal circular of October 15, 1869, required gardens, averaging from 70 to 150 square rods, to be appropriately laid out. In 1876 Sweden had 1,600, in 1881 2,000, and in 1894 as many as 4,670 school gardens. Of late years this number has somewhat diminished, since in the northern parts of Sweden more importance is at present attached to manual training, to which the State likewise contributes a large support. The character of the country, little adapted to agriculture, may be the reason for the lack of attention with respect to school gardens in Norway.

In middle and southern Russia small farms and gardens are beginning to be attached to people's or elementary schools in many villages. As a rule the community or resident landholders give the required amount of land free. The best developed gardens are found in the province of Jekatseinoslaf, in southern Russia, where 257 of the 504 schools possess such small model gardens, divided into sections for grain, vegetables and fruit, kitchen truck, grapes, and mulberry trees for the support of silk worms. In 1895 these schools collectively cultivated $296\frac{1}{2}$ acres of land, including vineyards, and possessed 12,000 fruit trees and over 1,000 beehives.

In Germany school gardens have not as yet been regulated by law; nevertheless the idea struck root twenty years ago. In some German States legislation for schools requires or defines it as desirable that each rural school should have a garden; but this is meant to serve more especially for the maintenance of the teacher. It is not so often arranged for purposes of instruction as may be desirable. The most

is done in the Kingdom of Prussia for the cultivation of fruit trees; nearly every teacher in the country possesses a small orchard. In the cities gardens are occasionally established to furnish the plants required for instruction in natural history. Such gardens, in which only certain kinds of plants are cultivated, are called *partial school gardens*. To provide pupils with plants for instruction in botany presents considerable difficulties in cities, and has occasioned the establishment of large gardens. Such central school gardens, which furnish at stated periods plant material (thousands of cuttings and specimens) to schools, exist in many of the large cities of Germany. The first was established in the Humboldt-Hain, in Berlin, and covers nearly ten acres. Since 1879 the city of Magdeburg possesses a central school garden in the Herrenkrug park, which contains a section of beds of nearly 62 acres; 17 acres are utilized for tree nurseries and 5 acres for the botanical division. Leipzig ranks next in order, with an area of 3 acres in 1888; in 1889 Breslau possessed 5 acres; Mannheim 5 acres in 1889; Dortmund 5 acres in 1890; Cologne 5 acres in 1891; Altona 3 acres in 1891; Karlsruhe nearly 2 acres in 1894; Elberfeld, Kolberg, Stettin, and other cities have gardens of greater or less extent. In many cases plants are arranged according to families. In the central school garden at Berlin the plants are arranged according to geographical zones.

Besides these, numerous smaller gardens have been established in connection with high schools and elementary schools. In Prussia school gardens have existed at the Wilhelm's Gymnasium, in Berlin, since 1875 (1.24 acres); at the Joachimsthaler Gymnasium, in Berlin, since 1884 (0.37 acre); at the Friedrich Wilhelm's Gymnasium since 1891 (0.11 acre); at the gymnasium at Wollin since 1888 (0.74 acre); at Bromberg since 1892 (0.2 acre); at Oldesloe since 1892 (0.21 acre); at the gymnasium in Witten on the Ruhr since 1891 (0.14 acre); at the high school in Giessen since 1891 (0.37 acre); at the normal school in Weissenfels since 1837 (0.86 acre); besides these various normal and agricultural winter schools are provided with gardens. Gardens are connected with elementary schools in Hamburg, Wiesbaden, Dortmund, Magdeburg, the suburban towns Oedenburg and Neustadt (0.07 to 0.21 acre); in Frankfurt on the Maine, Gerderath in Rhenish Prussia since 1881, and in many rural places.

In the Kingdom of Bavaria gardens are especially numerous in the Upper Palatinate; a ministerial decree requires them to be at least 0.12 acre in size. Special attention is given to the culture of fruit trees. The city schools of Munich are provided with plants for purposes of instruction from the botanical garden of the university. In the Kingdom of Saxony nearly all normal schools have gardens. Most of the elementary, or people's schools, are provided with gardens, even in large cities like Leipzig and Dresden. At the second international agricultural exposition in Dresden, 1896, the Teachers' Association of Saxony for nature study exhibited a complete school garden, which received both the gold and the State medals.

The Kingdom of Wurttemberg has proportionately few school gardens, for the reason that horticulture has flourished there for centuries. The normal school at Nürtingen has a garden of half an acre in size. In the Grand Duchy of Baden the conditions are similar to those in the neighboring State, Wurttemberg. The city of Karlsruhe has three small gardens connected with elementary schools, and the normal school at Meersburg has also a garden of insignificant size. In the Grand Duchy of Hesse gardens have been connected with the normal schools at Alzey and Friedberg since 1886, as also with several elementary schools. The schools of the Thuringian States are better provided. The normal school of Coburg has possessed a garden since 1875, that at Weimar since 1878, and Schleiz since 1890. The normal schools at Eisenach, Gotha, Rudolstadt, and Greiz have all gardens, but the date of their establishment is not known to the writer. The gardens connected with people's, or elementary, schools are mostly only partial school gardens; the one at Coburg with an area of 0.15 acre has existed since 1887; that at Neustadt, near Coburg,

0.62 acre, since 1885; that at Triptis, 0.50 acre, since 1890; that at Altenburg since 1892; that at Pössneck, 0.82 acre, since 1895. Gardens are connected with the burgher schools of Jena, Eisenach, Greiz, Schmölln, Rönneburg, Neustadt and Weida, and with the Luther-school at Gera. School gardens are also found here and there in the other German States. However, if they are to make further progress for the common benefit, they must be regulated by law and receive support from the State.

II. SITES AND ARRANGEMENT OF SCHOOL GARDENS.

For gardens to fulfill their purpose, they must be located either at, or near, the school building. In the construction of new school buildings this fact must be taken into consideration. With old buildings it is not always practicable to combine the two. However, a garden attached directly to the schoolhouse is of much greater value for educational purposes than one at a distance. If there be a choice of ground, soft, sandy loam of sufficient depth is to be preferred as best adapted for gardening. Moderately sandy or clayey soil possesses sufficiently favorable physical quality to be transformed into garden soil if it is properly improved and carefully worked. The presence or absence of water plays an important part in the selection of a garden site. No garden can thrive without water. Therefore, it is best to have an adequate supply, a stream or a pond, in or near the garden. To bring water from a distance entails too much labor and expense. Furthermore, the garden, as well as the building, should have proper exposure that air and light may have free access. The morning and midday sun should be able to exercise its warming and vivifying influence. All places exposed to violent draughts must be avoided or protected by appropriate planting, since such locations frequently retard garden labor, and many plants suffer from the cold winds to which they are exposed. On the other hand, when a garden is altogether inclosed, there is danger of making the plants too tender; this is especially disadvantageous with young fruit trees, as they are thus more sensitive to frost, and will not thrive as readily when transplanted to less sheltered locations. As school gardens are to exercise a broader influence and serve for the instruction of others, they should be so situated that at least one part faces the street or roadway, so that a survey of the whole can be made from that side.

The size depends upon local conditions, the number of pupils, and the number of sections which it shall contain. If the garden is to serve only for the purpose of instruction, it should cover about one-sixth of an acre. If it includes the kitchen garden for the teacher it must be at least one-fifth of an acre in size. But if grounds for play and gymnastics are likewise to be included, and this is an advantage, it must cover at least one-fourth of an acre. The gardens in Austria average about one-fifth of an acre. The ground for gardens must be donated by the community, and be placed at the disposal of teachers free.

After the site of the garden has been determined the fencing is to be next considered. The height of the fence should be above 5 feet, and the laths or pickets nailed about $1\frac{1}{2}$ to 2 inches apart, to make it secure against rabbits. Live hedges are never secure against rabbits; many, too—as, for instance, the white thorn—shelter destructive vermin. If for special reasons a hedge is to be desired, it should be of yoke elm or briars, or of privet closely trimmed and planted on either side of the lath fence. Generally it is more advantageous to make use of the fence for wall fruit, which is likewise trained over any neighboring wall or the sides of the school building. After the garden has been inclosed, the next step is its surface arrangement. When the ground has been portioned off, the teacher should make a design, laying off the walks and distributing the squares. The chief walk should not be too narrow—about 5 feet or a little over—as a great number of pupils must pass over it. The other walks may be only 3 to 4 feet wide. If the schoolhouse stands in the middle of the garden, its position must be taken into consideration in mapping out the

walks, as well as the sections. The walks near the schoolhouse, the main walks, and those of the vegetable section, must, one and all, be laid off in straight lines for the sake of symmetry and order. In larger gardens the scenic effect is heightened by laying off in curves the walks in the flower and ornamental plant section. Large city gardens may be arranged like parks, especially those parts that contain the shrubbery and grove sections, and the grounds for play and gymnastics. After the plan has been designed and drafted it should, by way of precaution, be examined by one who understands the subject before being carried into effect, as an impartial critic judges more clearly than one interested in the case. Moreover, the plan must be submitted to the school board for approval.

As soon as the plan is approved the arrangement of the garden may be begun. The walks and squares are first staked off. When the walks are dug to the depth of 15 to 20 inches the earth dug up may be used for leveling or for the manure pile. The walks are then filled in with broken stone, gravel, or cinders, and covered with sand. As firm and clean walks are an important factor in every garden, nothing should be neglected when making them. The squares, according to the plants to be raised, should be dug over to the depth of about 18 to 24 inches. The soil for trees should be furrowed to the depth of about 30 inches. As a matter of course, all large stones must be removed; they are best disposed of in filling up the walks. After the squares have been thoroughly spaded over and leveled, the required fertilizers are spread and worked in. The best fertilizer is stable manure, to which chemicals, guano, superphosphate, kainite, and bone dust have been added. To every 10 square feet of ground about 10 pounds of half-rotten manure, 5 pounds of guano, 5 pounds of artificial fertilizer (containing the required lime and other substances), or 3 pounds of bone dust, and 3 of kainite are required. If stable manure, combined with liquid manure, is freely used, chemical fertilizers containing nitrogen, as guano and saltpeter, may be dispensed with. All the heavy labor that is required to arrange the garden must be done by adults at the expense of the community, as it is not adapted for children. The best season for this work is late autumn.

III. THE DIFFERENT SECTIONS.

The contents of school gardens must be adapted to given conditions, the same as their size depends on local conditions. The requirements of a rural school are altogether different from those of a city school. Gardens for boys' schools are arranged unlike those for girls' schools, and those connected with normal schools, or other secondary institutions of learning, have not the same appearance as those of country schools, as gardens of private schools are distinguished from those of orphan asylums.

A complete school garden that is to include all important products, must contain a tree section, a vegetable garden with beds cared for by pupils, a botanical division, an agricultural experiment field, a flower garden, a beehive, and different ornamental plants. The given conditions, however, and the governing local necessities must decide which of them is absolutely necessary, desirable, or superfluous at any one place; the selection must be made accordingly. With respect to local necessities three different kinds of gardens may be accepted as standard: (1) the garden of a rural school; (2) the garden of a town school; (3) the garden of a large city serving a school system.

In gardens of rural schools the important sections are the tree section, the vegetable garden, the agricultural experiment field, the botanical division with commercial, textile, medicinal, and poisonous plants, and the beehive. Flowers, dwarf and berry fruits need take up very little space, and can under some circumstances be planted in borders. Where a forest is near, forest trees and shrubs need not be raised in the nursery. According to demand, grapevines, hops, and willows can be raised in the tree nursery.

Gardens in a small town require a tree nursery, a vegetable garden with beds cared for by pupils, a botanical division with commercial, medicinal, and poisonous plants, a small flower garden, and a beehive. The agricultural experiment field may be replaced by a few experiment beds. If woods are far distant, the planting of the most useful forest trees is desirable, as is also a willow section, if willow weaving is an industry of the locality.

Gardens of a large city, as well as those established for secondary and higher schools, consist preeminently of a richly planted botanical division containing the most important types of native flora that will serve as specimens for instruction in natural history and biology. They should also include the most familiar forest trees and shrubs, ornamental trees and shrubs, and poisonous, medicinal, and commercial plants. The tree section should be conducted only on a limited scale, including principally dwarf and tub fruit trees, and might be confined to boys' schools. For girls' schools a number of vegetable and flower beds is desirable, as also a few experiment and pupils' beds. No one expects to find an apiary in a city garden. The grounds for play and gymnastics should be in a close proximity to the school—if possible, within the limits of the garden.

(a) *The tree section or tree nursery.*—The great economic significance of fruit culture in Germany and all other civilized countries requires every school garden, especially those in rural districts, to contain a tree section. Boys must learn how to cultivate fruit trees. In rural gardens the tree section should form one-third of the whole; the second third should be arranged for vegetables, and the remaining third apportioned for the other subdivisions. The ground set aside for the tree section should be trenched to the depth of about 30 inches and be then laid out in squares subdivided into beds 4 feet broad. A portion of the beds should in the beginning be planted with purchased saplings. The others should be annually supplied with seed. The sowing, in rows, should take place in the fall or spring. During the summer the seed beds must be frequently watered and weeded. In the following year the saplings may be transplanted to another bed, at a distance of from about 8 to 10 inches apart, and improved later on. There are three principal methods of improvement: Grafting, budding, and inoculating. A year after improvement the young trees are again transplanted, three rows to the bed, each tree 2 feet from the other. Frequent transplanting makes them take stronger root. The training of the trunk takes place in the next four or five years. Every fall or spring the branches are clipped about 2 inches, and the trunk is allowed to increase naturally in height, provided it develops properly in circumference. If the growth in both directions is insufficient, the head of the trunk branch is clipped annually about one-third of its last year's growth, so that the branches may get thicker and stronger. Specimens that have weak and ill-grown trunks can be utilized to advantage for hybrid improvement. When the healthy young trees have attained a height of about 6 feet, the head of the trunk and all branches are cut off, leaving only the upper five nodes from which the crown, namely the head of the trunk and four branches, are developed at a height of 5 feet. One year after the trimming of the crown the young tree is developed, and can be taken up for permanent transplanting. The cultivation of dwarf trees must likewise be taught. Dwarf varieties presuppose a proper weakly growing stock. Dwarf apples are grafted on what the Germans call "Splittapfel" (French, "doucin"), or the paradise apple; dwarf pears, most frequently on the quince. The improvement must take place as deep down as possible near the root by means of inoculation or budding.

The most familiar dwarf forms are the pyramid, the palmetto, and the cordon. To train a pyramid a one-year-old scion on a dwarf stock should be cut off to 1½ feet. From the upper nodes in the same year the head of the trunk and four or five branches should be trained. If the tree is of vigorous growth, the second series of branches may be trained 9 to 11 inches above the first by pruning at this height. If the growth is weak, the head of the trunk should be cut back two or three nodes the

following year, and a strong year's growth be permitted to a height of from 9 to 11 inches. The new branch series can be formed the following spring. In this way the pyramid gradually develops. Pyramidal trees are planted either in borders or in special beds. A great variety of apples are specially adapted for that form. The palmetto form is chiefly used near walls and fences. It is raised by taking a one-year-old grafted tree, cutting it down to from 11 to 15 inches, and allowing only the three highest buds to develop. The uppermost bud forms the head of the trunk; the two others directed to the side form the branches of the first stage. In the following spring the head of the trunk is cut again at the height of 9 to 11 inches, so that the second stage is formed at this distance. A new stage of side branches is thus formed every year, until the wall is covered. The branches are tied to laths or wire, and are trained as nearly horizontal as possible. A great variety of apples and pears are suitable for this kind of treatment. Horizontal cordons are trained from one-year-old grafted trees by bending them over at the height of about a foot, and training them along a wire stretched horizontally. This form is especially adapted for edging walks or beds. Perpendicular cordons are trained on wires; they are specially adapted for high gable walls. For this form also certain species of fruit are recommended. In city gardens tub fruit trees may be added to the pyramid, palmetto, and cordon. Two or three year old apple or pear pyramids grafted respectively on paradise and quince are planted in tubs or buckets set in the ground in borders or beds. In winter they are protected from frost by being covered with earth or removed to a warm spot. There are special kinds of fruit better adapted than others for this treatment.

Besides large and dwarf trees, the tree section should contain several beds of berry fruits, more important at present since improved methods of transportation have made this summer fruit easily salable in cities. Preference should be given to the larger fruits, currants, and gooseberries. With limited space, they may be planted in the borders. Raspberries should be planted in a somewhat remote corner on account of their spreading roots.¹

In city school gardens a part of the tree section is devoted to the most familiar forest trees and shrubs and to some ornamental trees and shrubs. If willow weaving is a flourishing industry in any one locality, attention is likewise given to the cultivation of osiers. In vine-growing districts a small vineyard is a requisite, and in hop raising districts a part of the garden should be planted in hops. In suitable districts an impulse might be given to raising silkworms by planting of mulberry trees and scorzonera.

(b) *The vegetable or kitchen garden.*—The vegetable garden ranks next in importance to the tree nursery, as the immediate utilization of vegetables in the household teaches their usefulness. Girls show the greatest interest in this division, and plant the beds with all kinds of vegetables of their own accord. This section should be laid out in several subdivisions. A comparatively large portion is required to show the complete management of vegetable culture. In school gardens which include the teacher's kitchen garden the latter may be used to exemplify the proper management. The portion chosen for the regular management is best utilized by the "three-field system." After laying out the permanent beds, such as asparagus, the remaining surface is divided into three parts. In the first, plentifully supplied with fresh manure, perishable vegetables, such as kale, turnip-cabbage, celery, gherkins, spinach, leeks, lettuce, and the like, should be planted. The second division is not freshly manured and is planted in better keeping vegetables, such as potatoes, carrots, turnips, and radishes. In the third, which likewise receives no fresh manure, but only a light covering of soot or compost, long keeping vegetables, as pease and

¹The author states the species best adapted in each case (tree fruit and berry fruit), but he gives them German and French names, different from those they are known by in this country. Hence the translator omits them.

beans, all kinds of onions, shallots, cibols, etc., should be planted. The division in which the perishable vegetables were planted the first year receives the moderately keeping the second, and the long keeping the third year. The fourth year it is again plentifully manured, and the rotation begins anew. By applying the "three-field system" good results are obtained from moderate fertilization, and the regular change prevents any one bed from becoming easily exhausted. That part of the garden used to teach the regular management must distinctly bring to view the best utilization of soil in one and the same bed by rotation crops, as well as the value of interplanting with some kinds of vegetables. If the teacher cares to take the trouble, the plants to be set out in the beds can be raised in hotbeds in the garden. Many kinds can be raised by early sowing in flat cases under glass cover, and setting out later. In this way early vegetables can be had in advance of the season. The best adapted for early growth are pease, dwarf beans, cucumbers, lettuce, and potatoes. Of course the species that grow quickly and mature early should be selected.

The kitchen garden must furthermore contain the required beds for pupils, which are much more necessary in the city than in the country, where most children are actively employed in their own home gardens. These beds should border on one side of the main walk, so as to be of easy access. Each should measure about 10 feet square, and they should be planted by the children according to their own measurements. The number depends upon the number of children that report themselves willing to take charge of them. A few beds must be reserved for experimental purposes, either for trial of new kinds of vegetables or for comparison. A few appropriately situated reserve beds should be planted to obtain seeds. The kitchen garden receives the greatest attention in so-called housekeeping, cooking, or domestic-science schools for girls.

(c) *The botanical division.*—In a garden of a large city in which the botanical section furnishes the specimens for instruction in botany and biology, the greatest attention should be given to the most important native plants. These should be arranged and grouped according to the natural system of classification. Only the most important and characteristic representatives of the various families should be considered. The following families deserve a place: Papilionaceæ, Cruciferae, Gramineæ, Lynamtheræ, Labiatae, Umbelliferae, Liliaceæ, Orchidallæ, Campanulaceæ, Ranunculaceæ, Papaveraceæ, Caryophyllaceæ, Violaceæ, Malvaceæ, Geraniaceæ, Primulaceæ, Valerianaceæ, Hypericaceæ, Linaceæ, Saxifragaceæ, and a few others. Ornamental shrubs and trees might be arranged in groups without distinct limits. According to space the following may be considered: Elder, snowball, honeysuckle, cornel, spiræa, white and red thorn, Japanese quince, lilac, hedge cherry, snowberry, hazelnut, juniper, etc. In sufficiently large gardens, especially when grounds for play and gymnastics are included, groups of trees may be planted. The most familiar foliage trees should be selected, and must be planted in such a manner that the higher trees do not injure the lower. The botanical division must contain special beds of the most important commercial and textile plants, such as flax, hemp, hops, tobacco, chicory, colza, maize, millet, sugar cane, etc. The following medicinal plants can be grown and united into one group: Camomile, mullein, fennel, anise, arnica, centaury, peppermint, sage, balm mint, and wormwood.

A somewhat remote, well-inclosed space should be reserved for the poisonous plants, and warning notices be posted in the beds. The most important specimens should be represented, as nightshade, belladonna, thorn apple, wolfsbane, henbane, digitalis, petty spurge, bittersweet, purge flax, hemlock, fool's parsley, oneberry, poisonous crowfoot, and meadow saffron. The special soil and locality required by some medicinal and poisonous plants must be given, as far as possible, by appropriate soil mixture and grouping. It is advisable to label all the plants, as well as the groups in the botanical division, with small placards of wood, tin, or porcelain, giving the names in the vernacular and also in Latin; but if the plants are

to be first defined and analyzed during instruction in botany, as is often the case in high schools, it is advisable to designate the plants by numbers.

If a small pond can be dug in the garden,¹ it should not be left undone. The banks should be planted with a few characteristic marsh and water plants, as rushes, mace reeds, calamus, water violets, water trefoil, snakeweed, arrowhead, and iris; white and yellow nymphæa should cover the surface of the water. The pond should be stocked with all kinds of small aquatic animals, as frogs, salamanders, newts, water beetles, pond muscles, smerlins, sticklebacks, goldfish, etc. A rockery built of the most important native rocks and some crystallized minerals ornamented with creeping plants, ferns, and sweet broom adds a great deal to the beauty of the garden. In rural gardens only textile, commercial, medicinal, and poisonous plants need be cultivated. Cereals, fodder plants, and grasses are reserved for the agricultural experiment field.

(d) *The agricultural experiment field.*—This section is found only in rural gardens and, as the name indicates, serves for practical experiments. It contains the most useful cereals, fodder plants, and grasses. Cereals should include wheat, rye, barley, and oats; for experimental purposes, maize, spelt, and buckwheat. Special varieties of these grains must be represented. The following forage plants should be planted: Red, white, carnation, and yellow clover, lucerne, sainfoin, serradilla, lupine, white mustard, fodder, sand and bird vetch, beets, cabbage, turnips, and a few kinds of potatoes. The following fodder grasses deserve attention: Sweet-scented grass, couch grass, fescue grass, herds' grass, cat's tail, English and Italian ray grass, hairy reed, millet, yellow oat-grass. These plants should be so grouped as to form small grain and clover fields, beds to be hoed, and meadows. Meadow flowers may be added to the grasses. The weeds will sow themselves; the hurtful properties of each and the means for their destruction must be spoken of during instruction. Finally the agricultural experiment field must contain a few experiment beds in which new kinds of clover and grain and crops to be hoed may be tested. The comparative trials made on these fields refer to the different ways of working the ground, to fertilization, seedtime, sowing, size of seeds, etc. The agricultural experiment field is of the greatest importance to agricultural and continuation schools.

(e) *The flower garden.*—Flowers are favorites with children, especially with girls. This fact is best observed in a walk through fields and meadows. How active the children are in gathering the blue cornflowers, the red poppy, and the brownish cockle, to tie them into bouquets mixed with daisies and forget-me-nots. Joyfully they take their flowers home to mother for her to arrange them about the house. This love for flowers should not be disregarded in the education of children; it must be strengthened in school, directed to a noble purpose and applied to instruction. The culture of flowers, therefore, deserves special attention in school gardens. The very smallest gardens should contain these favorites in the borders: Roses, pinks, pansies, asters, wallflowers, lobelia, phlox, mignonette, fuchsias, primroses, begonias, geraniums, gillyflowers, hyacinths, and others. Larger gardens may include whole groups of magnificent and perhaps more fashionable flowers; carpet beds of various forms and combinations of color may be laid out. In girls' schools, especially, pupils' beds should be laid out, devoted entirely to flowers. A number of flowers and leafy plants in pots should ornament every schoolroom. During intervals of recess the larger girls can attend to them, and so an interest in flower culture may be awakened and fostered. Horticultural societies undertake a gratifying task when they distribute plants in pots among children free, awarding prizes to those who take the best care of their plants. The care of flowers develops a taste for what is beautiful, attractive, and comfortable in a home. It preaches order, cleanliness, and punctu-

¹ That is, if the configuration of the surface facilitates it, and a spring can be led to it to supply the water.

ality; therefore it is an indispensable means for the education of women. Flowers are often the only friendly sight in a small, gloomy dwelling; they are in fact often the only ornament that lends a charm of home to the dwellings of the poor; sometimes they are the only light in a troubled existence! Therefore it is a duty to cultivate the love of flowers as far as it lies within our power. Girls should feel the ennobling power awakened by contact with flowers, and enjoy the pure pleasure, quiet happiness, and contentment derived from it. Even among the wandering tribes of gypsies and rope dancers tender hands are sometimes found that show love of flowers enough to raise a few geraniums or fuchsias on the window sills of their ambulatory home. Considering their uncertain whereabouts and more than modest dwelling, this certainly deserves recognition and rejoices the heart of all who love flowers. The more we cultivate the love of flowers, gardens, and the beauties of nature in children, the surer we lay the foundation for esthetic culture and a contented disposition. The care of flowers also leads to a regard for other creations in nature. The more this is developed the less often trees and all kinds of plants will suffer injury from rude hands; useful animals will not be so frequently persecuted and tormented.

(f) *The apiary*.—The industrious bee plays an important part in the economy of nature. It is almost indispensable for the fructification of some flowers. Bee culture, likewise, brings in material gain through the much-prized products of honey and wax. The observation of these useful insects also affords many pleasures. The attentive observation of their virtues, as industry, sense of order, obedience, and readiness to render mutual assistance, excites many an impulse in the thoughtful student, and exercises a beneficial influence on disposition and character. Unfortunately, bee culture has not received the general attention which its importance deserves. Therefore gardens in rural districts and small towns should give the required impulse and awaken a new interest in these useful insects by accustoming boys to contact with them. That the bees may not be troublesome to the children in the garden, the hive should be located in a remote, dry, quiet place; the direction of flight should be toward the southeast. Four to six swarms are sufficient. The system of movable combs is generally preferred to the antiquated stationary structure. It must be left to the decision of the teacher what system is to be adopted; much depends upon his experience. Plants that furnish food for bees should be raised near the hive and in the space before it. The following can be recommended: Shamrock, mignonette, thyme, sage, borage, sunflower, gooseberry, currant, snowberry, and others.

(g) *Ornamentation of the school garden*.—To combine the attractive with the useful, school gardens should be beautified within their limitation. For this purpose arbors may be constructed in which pupils and teacher can take shelter in a storm, or where lessons may be conducted. They are specially indispensable where gardens do not adjoin the schoolhouse. When location and ground are favorable, a fountain with a roomy basin should not be omitted. The basin can at the same time be arranged as an aquarium, stocked with water plants, goldfish, smelt, minnows, water beetles, and other small aquatic animals and ornamental fish. Small waterfalls, artificial rockeries and grottoes likewise add to the beauty of the garden. Bird houses of various kinds should be provided, and food be scattered in winter, as such arrangements teach and insure the protection of birds. An easily accessible place to procure water, well or tanks for watering the plants is very essential.

(h) *Garden implements*.—In planning a garden the necessary implements and a store or tool house must not be forgotten. The following are required: Several spades, hoes, iron rakes, a shovel, a grafting saw, several rose shears, a sufficient number of scythes or sickles, grafting or pruning knives, several ladders of different length, and a goodly number of watering cans, a hatchet, a hammer, pincers, and a supply of cords, pegs, etc. These implements are to be furnished by the community like all other school appliances, and must be kept in good condition.

IV. MANAGEMENT.

The management of a school garden requires not only a proper understanding and full command of the subjects to be taught, but a broad view of the work to be done. This can be gained only by an exhaustive plan of work which the teacher must arrange and follow. The plan must cover the work for the whole year from spring to autumn, and define what is to be done each week. Each year the work must be planned anew, changed or supplemented. Two or three hours a week in the afternoon, after school hours, must be reserved for gardening. In urgent cases the hour for gymnastics may be taken up by gardening. In rural schools with a small attendance all the pupils may be occupied with this kind of work, according to their ability. In city schools the intermediate and upper grades only need take part. Applicants for work in the garden are, of course, accepted at any time. If the number of pupils is large, it is desirable and necessary to arrange them in different divisions, ten to twelve in a group, and appoint a foreman. In the tree section the work is done by older boys. Early in the spring the seed beds are dug over and leveled when the seed is sown. They are then covered lightly with moss or brush, to keep the ground damp, and are frequently watered. One-year-old saplings and one-year-old grafted trees are transplanted to beds that have been dug over and otherwise properly prepared for them. Young fruit trees are to be taken up and planted anew. Older fruit trees and berry shrubs must be pruned, if it has not been done in the fall. The ground around the trees is freshly loosened and manured. Single branches of specimen and test trees are again grafted, for which the scions were already cut in January. Strong saplings are improved by budding or grafting. The preparation of mummy is at the same time discussed. Strong stocks are pruned to the crown, while the growth in height of weaker ones is retarded.

After this spring work is done the beds are hoed for the first time and weeded. During the summer the thriving scions are fastened to poles and the wall and dwarf trees are repeatedly nipped and supplied with liquid manure, and, when necessary, watered. In July and August the young saplings are grafted and the bandages of the spring grafting loosened so far as the cord tightens. Injurious influences on fruit are to be counteracted. In the course of the summer the beds are hoed for the second time, leveled with the rake, and the clumps broken and smoothed with the spade. The compost pile is repeatedly spaded. In the fall the branches of saplings and stocks are clipped and cut off smooth, the graft bandages are loosened, and the beds are again roughly hoed. After the harvest the older fruit trees are brushed off, cleaned with moss, straw, and broom, whitewashed, and provided with sticky girdles. The tops of the trees are pruned, the ground around their roots is loosened and fertilized with lime and compost, and the holes for winter or spring planting are dug. Varieties are studied from the ripe fruit. Crops and the preservation of fruit receive theoretical and practical attention. Young trees are freshly tied up and protected for the winter against game by being wrapped in straw or thorns.

The work in vegetable and flower gardens is done by girls, since they, as future housewives, will assume the care and management of the home garden. The borders and beds are dug over and leveled in the spring. The teacher shows the girls how to manage the garden implements and teaches them how the work is to be done. Flower and vegetable seeds are sown and a few early beds are planted. The sprouting seed is weeded and frequently watered. In the course of the summer vegetable beds are frequently weeded, hoed, and watered. The walks are also cleaned and kept in good condition. The beds are staked off by the teacher with the help of some of the boys, and are arranged, as far as practicable, equal in size. They are then distributed among those children who are willing to undertake their care and management. Each child works its own bed independently and plants it ad libitum at

individual expense. It is also entitled to the crops, provided it cares for the plants in its bed during summer. The best pupils' beds are commended in the fall, and those in charge may be rewarded with premiums. A notice giving the name of the child in charge must be attached to each bed. Although the beds are planted according to pleasure, a certain uniformity should be aimed at for the sake of appearance. Vegetable, flower, and kitchen-garden beds should be at some distance apart. Several experimental beds, serving for comparison and the test of new varieties or seeds, are cared for in common.

The work in the agricultural experiment field and in the botanical division takes up very little time; it is confined mostly to weeding and hoeing and is undertaken in common. Boys alone are to be engaged in bee culture. Before they apply themselves to the study of the living insects they are instructed in the most important facts concerning their existence, habits, and characteristics. The three different kinds of bees in a hive are discussed with reference to their outward appearance, and the structures of the cells and the internal arrangement of the hive are explained from an empty hive. In order to show the life in a hive clearly, it is desirable to have a so-called hive for observation, which the teacher can arrange in the following manner: A very small hive with only six frames should have glass walls lengthwise, covered on the outside with wooden doors. The frames are set two by two in three rows, one above the other, so that each comb may be observed from without on both sides. The entrance is at one of the shorter sides. In May the hive is stocked with the necessary material and placed in a somewhat isolated position. The old queen is taken from a populous hive and placed in the lowest section of the hive, together with a brooding comb; next to it is placed a comb with a hatching brood. Above these two frames two empty combs are set with workers' and drone cells, and above these two combs with honey supplies. In this observation hive the teacher can show the three kinds of bees in their occupation, draw the pupils' attention to the laying of the eggs by the queen, and explain the purpose of the structure for workers and drones. Then the queen may be removed and a new one brought up. Now it will be observed how a tribe acts without the queen bee, how the queen cells are arranged and built, and how the bees raise workers' larvæ to queens, how the first queen slips from the egg, the subsequent hatching of the others, which are, as a rule, stung to death by her, and, finally, the time required to hatch a worker, a drone, and a queen (sixteen, twenty, and twenty-four days). If the work during the summer has been favored by fine weather and plentiful crop of honey flowers, the hive may be increased by two frames of artificial combs, whose building may be noticed, together with the storing of the honey, from which the queen is excluded by means of a grate partition. In the fall the killing of the drones may be observed, and, finally, a young reserve queen may be kept on hand during the winter.

The teacher should keep a simple daybook, recording receipts and expenses and notes on the experiments undertaken. The care and supervision of a garden in connection with a school require much time and trouble. The community should therefore pay a small sum annually for the teacher's services as head school gardener. An appropriation should also be made for the purchase of seed, seedlings, props, labels, cord, etc. The produce belongs in part to the teacher, namely, fruit, berries, honey, and vegetables. A great deal, of course, is divided among the children; and seeds, cuttings, fruit, etc., are given free to any one interested. The produce of the pupils' beds belongs entirely to the children. The returns from the tree nursery go toward the school fund, but the commendable custom of presenting exemplary boys with a fruit tree at the time of their graduation deserves to be continued.

V. INSTRUCTION IN THE SCHOOL GARDEN.

The laying out of a garden always has a distinct purpose in view. As a rule, this is its economic value. The end and aim of school gardens, however, are different.

They are by no means primarily designed as a source of revenue for teachers and community or for utility in the general sense of the term, but for purposes of instruction and education. It is true that teachers' and pupils' industry is rewarded in a material way. Agriculture in its different branches, especially fruit culture and horticulture, is also promoted, and for this reason, perhaps, school gardens are maintained in some countries. But their chief value consists in their advantage for the education of youth. As schools are institutions of learning and training, so also are school gardens. They bear the mutual relation to each other of egg and shell. Gardens are a necessary part of schools and attain their educational value by being connected with them. "No instruction without observation" is the watchword of our times. By means of gardens this demand can be met. In many cases they furnish numerous specimens for object lessons, or are themselves excellent means for observation; in others they give many points for comparison that have the value of direct observation. Thus they are valuable supports for observation in instruction. Instruction in gardens appears partly as occasional lectures, partly as defined lessons, partly as practical work, and partly as constant nature study. The practical work in gardens affords many opportunities for information of various kinds. In digging the beds the necessity of working the ground is shown, the different kinds of soil may be discussed, the use of implements demonstrated, and the application of the laws of physics in their regard explained. The habits, characteristics, and qualities of insects and small animals which the children find are discussed, and they are made acquainted with the useful and injurious animals, are exhorted to protect those which are of use and to destroy those which are harmful. In sowing, planting, hoeing, weeding, and watering, the teacher can give appropriate hints and show the practical manipulation of the implements. Many natural phenomena give him the opportunity of explaining natural laws and of applying what has been learned. In gathering the crops the attention of the pupils is drawn toward the commercial uses of the different kinds of produce, and the value of each as an article of food is considered.

Besides the occasional instruction the teacher should conduct some of the regular lessons in the garden when the weather permits it. The greater number of lessons in nature study must be given during the summer out of doors, as the garden furnishes the best subjects for direct observation. Thus a lesson in natural history may be given in the garden on the different kinds of soil, their improvement and appropriate working; another on the nutritive organs, growth, and conditions of the life of plants; a third on their transplantation and propagation; besides, a lesson each may be devoted to the different kinds and forms of leaves, flowers, and fruit, useful animals, the destruction of enemies to fruits, the practical protection of birds, etc. In speaking of the tests of comparison which the teacher has appointed the lesson should be conducted at the experiment bed after its examination. For instance, first experiment: In a bed one half of the cabbage plants have been manured with fertilizers rich in nitrogen, while the other half have not been fertilized at all or have received no extra amount of nitrogen; result, the former have attained a luxuriant growth; rule, fertilizers rich in nitrogen promote the growth of leaves. Second experiment: Plant beets, radishes, and the like in one bed; nip all but two heart leaves of one half of them and let the others grow undisturbed; result, plants that have been deprived of their leaves develop small, insignificant roots; rule, loss of foliage is harmful, as it weakens the plant. Third experiment: Plant a bed in carrots; sow one half thick and the other half sparse; plant another bed similarly in cabbage or celery; result, where the plants are close together their development is poor; the others are much better; rule, setting plants too close together injures their growth and consequently diminishes the crop.

Similar experiments can be made with planting deep, with the choice of seeds, the rotation of crops, etc. All such experiments, however, the teacher must arrange in direct connection with the plan of study. He must note where and when he intends

to make use of the garden for instruction and observation. According to Jung, the noted natural-history teacher in Kiel, very serviceable subjects of instruction can be gained by arranging the objects in the garden in groups "en miniature." Lessons and reviews may include: The plants and animals found in the garden; the most beautiful and useful forest trees in the garden; the useful shrubs; flowers and their forms; the apple tree as a protector; the most beautiful field flowers; the best forage grasses; the three-field system of agriculture and horticulture; the useful garden insects; the destroyers of fruit and useful plants; plants injurious and plants useful to man; plants raised for food, clothing, and building purposes or medicine.

Besides natural history, geometry, physics, and mathematics, in part, may be taught in the garden. Thus, a class of pupils, under the teacher's direction, can measure off the garden and beds and calculate areas. The pitch of the ground can be calculated by means of a leveling instrument or a water level; the height of a tree or a house can be ascertained by the length of its shadow and the area of variously shaped beds and subdivisions can be found, and the value per acre of crops estimated; finally, the calculation of surface and volume may be combined with the classification of all kinds of geometrical figures, as circles, ovals, rhombs, triangles, squares, polygons, columns, cones, spheres, etc.

Countless specimens for other studies are furnished by the school garden; as, for instance, for drawing leaves for the study of their outline, parts of flowers and foliage; furthermore, objects for perspective study, as beehives, arbors, nesting boxes, etc. Many physical laws are exemplified for the study in the class room, as, the construction of a fountain as an example of communicating vessels; the well as an example of the suction pump; ripe fruits fall in consequence of the law of gravitation; water poured into the saucers under flowerpots will rise in obedience to capillary attraction; the temperature is higher underneath the snow than in the open air, because of obstructed radiation; the air is cooler after rain on account of evaporation; the sun's rays exert a stronger influence on slanting hot-bed covers the greater the angle of incidence; dark objects get warmer more quickly than light on account of less reflection, etc.

Abundant material for compositions is likewise furnished. Language lessons are plentifully supplied with subjects of discussion. Subjects for compositions are: The garden in summer and in winter. My flower bed. The life of the honey bee. Why are fruit trees planted? How is a bird cage or a nesting box made? The uses of singing birds. How to fight the enemies of fruit. The gardener's friends among animals. Why is the goat of no use to the gardener? The garden also furnishes much material for the study of home geography and singing.

In schools of more than one division, all can receive outdoor instruction. In rural schools of but one division the small children may be left in the schoolroom under the superintendence of an older pupil while the upper and middle classes, either together or alternately, may be occupied with outdoor lessons. Outdoor instruction is warmly advocated by educators of the present day. The December conference of 1892, held in obedience to a call of Emperor William, recommended it in these words: "Outdoor instruction shall be furthered in every way for the study of the natural sciences as well as for the study of the home geography and home history." The school garden is naturally the best place for such instruction.

Finally, instruction in gardens suggests constant observation of natural phenomena which the children can make under the teacher's direction. They refer to weather conditions, sunrise and sunset at different seasons, winds and clouds, development of plants from germination to fruit formation, the actions of useful and harmful animals, blooming plants, and other things. In order to be able to set such tasks, the teacher himself must be a diligent observer of nature, and must have planned a series of lessons for the seasons, months, and weeks. These observations are a preparation for instruction; they render the senses more acute, exercise thought and judgment, and arouse interest.

VI. EDUCATIONAL AND ECONOMIC SIGNIFICANCE.

The latest efforts of pedagogy have been directed toward harmonizing school instruction with the demands of practical life. Our time demands an education based especially upon a broad knowledge of the natural sciences, by means of which those facts and experiences are acquired by self-observation and self-activity which will benefit the pupil in his later life. As that instruction is best which is based on or derived from actual observation, whose fruits the pupil gains by his own labor, and as the school garden is the richest storehouse for lessons in the natural sciences, it necessarily follows that gardens are a valuable adjunct of the modern school. The reforms in the teaching of natural science, advocated lately, emphasize the grouping of the matter of instruction according to common conditions in life which exemplify the mutual influence of different forms of existence upon one another. This method makes good results justly dependent upon the continued well-directed observation, and that observation on the part of the pupil requires gardens in order to have the means near at hand, under the control of the teacher, and without loss of time. These actual observations awaken intense interest, render the senses very acute and judgment clear. Daily contact with trees, flowers, and other natural objects awaken pleasure in them and love of nature. The knowledge acquired by direct observation necessarily leads to a proper appreciation of the natural forces and their effects, to the admiration of natural beauties manifested in bright colors and lovely forms. A school garden in the full height of its summer glory, moreover, gives to children a proper understanding of poetry; in short, it offers both matter and method to an æsthetic education, such as nothing else can give.

Besides being an invaluable aid for instruction, school gardens are also excellent means of training. Their chief purpose is training for work, a purpose which they have in common with other institutions. All children, large and small, can be occupied according to their capacity, and the very occupation gives them pleasure, develops a liking for labor, and strengthens self-confidence in their own power. Moreover, work in the fresh air is much better for children's health than that in the school workshop. This is to be no reflection on the latter, but merely a statement of fact. Where workshops are a necessity, in industrial districts, they are beneficial and promote national prosperity. They may, in fact, be easily and advantageously connected with gardens. In autumn and winter the boys can benefit by manual training in the school workshop.

Garden work, properly directed, and managed with pleasure and understanding, promotes industry, attention, judgment, skill, and self-reliance; it develops the sense of order, cleanliness, punctuality, beauty, responsibility, and duty, and, consequently, forms the foundation for a firm will and self-reliant action, or, in other words, for a moral character. The free intercourse in the garden gives teachers opportunities of knowing their pupils better in a short time. They are consequently able to direct the education of individuals in the best way and by the most appropriate means. The work in common also arouses public spirit in children, the sense of fellowship, and mutual dependence. It awakens an esteem for all manual labor and a proper judgment and valuation of the work of others. Children learn, above all things, that "in work there is no shame," and that "idleness is the mother of evil." The educational influence of labor is great and lasting. At sight of this or that plant the mature man will, in his own fields and garden, recall the time when he first learned something of it in the school garden. Many things obscure then are clear to him now; however, he does not underrate the early impulse, and will certainly not fall behind the boy in zeal, judgment, accuracy, and activity.

An institution like the school garden, that combines so many educational forces, will hardly be deprecated by prudent educators. Many of them at present maintain a favorable opinion of school gardens and advocate their establishment. M. Vierthaler says: "The example of the ancient Persians deserves to be imitated.

With them a knowledge of agriculture and horticulture was required by law of the King's as well as the slave's son." Kellner, school councillor in Treves, says: "I recommend, above all things, horticulture in all its branches to the teachers of rural schools." "Manual labor, such as gardening, light cabinet-making, and turning, promotes the boy's physical development."—(Sailer.) "The advantages of even the smallest garden are so many and so great that no school should be without one."—(Demeter.) "A school without a garden is like a stag without water."—(Dr. Georgens.) "School gardens are a foundation for the knowledge of nature and its consequent pleasure, and an excellent means of training."—(Professor Schwab.) "Not trees, shrubs, herbs, and grasses alone are what we offer the children in the school garden, but love of nature, labor, and home."—(F. Langauer.) "The question of school gardens in the development of public schools is gaining in importance every day."—(Maresch.) "No public school should be without a garden; every community that resolves to connect a garden with its school is laying up capital whose interest it enjoys in the prosperity of its future members."—(Jablonzy.) "The hour must and will come when the eyes, until now struck with blindness, shall be opened and see that the institution of school gardens has become the greatest blessing for the people."—(Sprenger.)

Finally, school gardens are of paramount economic significance. Franz Langauer, of Vienna, makes the best characterization by calling school gardens the pioneers of agricultural progress. As elementary schools lay the foundation of all subsequent education, so all beginnings of civilization, all progress of industry and agriculture proceed from them. To manage his affairs at all successfully, and be able to enter into competition, even the farmer of the present day must possess a certain amount of knowledge of natural science. The first elements of this he learns in the elementary school. And the shortest and safest way of attaining this end is through his own observation, his own activity, his own experiments in the school garden. What the boy learns he will later on utilize in the management of his property; therefore the impetus and the progress that are observed in agriculture in several countries are mainly the result of school gardens. The pleasing impression left by them on the residents of towns has its unmistakable influence upon home gardens. The teacher's diligence and punctuality are imitated by the people who try to make their gardens excel in cleanliness, beauty, and productiveness. The closer the intercourse is between teacher and people the surer this favorable influence will be. These conditions are soonest realized where gardens are open to the public on Sunday; teacher and neighbors both benefit by a free and easy interchange of thought. The beautiful fruit raised awakens a desire in visitors to possess one or another kind of seed to raise the same varieties at home. Seed can be furnished in abundance, and thus desirable kinds of fruit and vegetables, beautiful flowers, and the like, are spread, to the advantage of the community. Often new varieties of vegetables, fruit, and flowers, or truck-garden specialties, as asparagus, strawberries, vegetables, and roses and other flowers are introduced especially through school gardens near large cities, and in a short time are so generally cultivated that they become a source of income to the population and help to advance prosperity. The shady arbors, the magnificent rose bushes in the borders, the full vines on the walls, and the laden pyramid fruit trees in the beds are admired by many, who resolve also to do something toward beautifying their homes. Many a one, since his visit to a school garden, no longer lives in a thicket of brush, or surrounded by bogs, hemmed in by ungainly willows and alders. Now his vine-covered house stands in the center of a friendly garden and the windows look out upon blooming plants and heavily laden apple trees that shade the broad, level village green. "A good example deserves to be imitated" is justly applicable to the school garden. One that is kept in order serves as a model in many ways. Many a village is indebted to school gardens for its outward attractions.

These gardens also exert an educational influence upon the maturer members of the community, for in them are taught the youth who are beyond school age and attend continuation schools (evening and holiday schools), the most important principles of agriculture, showing by practical experiments how agriculture must be carried on to be profitable, offering productive specimens, and warning against mistakes. School gardens are a preventive against degeneration; they promote excellence of performance. Thus they are pioneers of civilization, promoters of practical progress, and sources of prosperity in communities.

The establishment of a school garden is easy in most places, since nearly all school buildings have some ground that may be reserved for the purpose. Every new school building, however, should be planned with the view to connecting a school garden with it. This should be legally provided for. Not only the State and the community, but agricultural and horticultural societies are interested in the establishment of school gardens, and should give their support in advancing the idea. Special gardens should also multiply in future. At present almost all normal schools in Germany, Austria, Switzerland, Sweden, and Denmark possess gardens in which the future teachers are trained and taught in agriculture and horticulture.

The idea of school gardens is so simple and natural that the coming century will wonder how public educational institutions could ever have existed without them and been true to their purpose.

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