

Commencement Thesis.

Light and Ventilation in City Schools.

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Light & Ventilation in City Schools. 202

Outline.

Introduction.

- (a) Progress of Education
- (b) Subject matter & methods in schools.
- (c) Importance of caring for the health & the tendency towards its neglect.
- (d) Comparison between city & country schools.

Light.

- (a) Effects produced by insufficient light & confinement.
- (b) Direction of light - (bad & good).
- (c) Size of school-rooms & the amount of window space for admission of light.
- (d) Duties of teachers in seating pupils.
- (e) Arrangement of blackboards.
- (f) Location of school buildings with regard to light.
- (g) The duty of the public & scientists.
- (h) Education & enthusiasm necessary to avoid the dangers of neglect. Conclusion.

Ventilation

- (a) Relation to lighting buildings.
- (b) Unsatisfactory progress in ventilation.
- (c) Perfect & good ventilation.
- (d) Expense of ventilation & relation to climate.
- (e) Conditions of the atmosphere & the amount of impurities in contents.

Ventilation - Concluded.

- (f) Actively & negatively poisonous gases.
- (g) Importance attached to Carbon dioxide in the air, as an index to the quantity of other gases present.
- (h) Effects of impurities in the air upon children.
 - (i) Causes of disease - (foul air.)
- (j) Our neglect of the circumstances around us.
- (k) Location & surroundings of school buildings & room for play-grounds.
- (l) Rules & plans for ventilating, their dependence upon climate.
- (m) - Comparison of Oakland (California) children with children in eastern cities.
- (n) The influence of wholesome air in unlimited amount?
- (o) Duties of architects & builders.
- (p) Difficulties of securing ventilation.
- (q) Inertia of city officials for welfare of school children. Expense of municipal government.
- (r) Methods of ventilating & factors that influence them
- (s) Amount of air that should be supplied.
- (t) Ventilation by means of flues & registers.
- (u) Moisture in the atmosphere - its importance.
- (v) Difficulty of heating air & the introduction of moisture in it.

Conclusion.

- (a) The problems of light and ventilation as an economic policy.
- (b) Needed reformation in this branch of education.
- (c) Our duty to arouse activity and public enthusiasm.
- (d) Future anticipations of reform upon the general character of children and men.

It may be a commonplace expression but it is a profound truth that we are living to-day in the midst of revolutions.

The opening up of new fields of scientific truths, leading in their application to thousands of new inventions and improvements in methods, forces us to analyze ^{and} readjust our industrial life ^{and} our educational ideas.

Education never leads in the development of such readjustments; sometimes it is even a century behind, but to-day it is following closely the newest ^{and} the best ^{and} is working out great changes. Our views as to what should be taught in the schools are changing; the ways ^{and} means of educating children ^{and} the class that ought to be educated, have undergone a complete revolution. In regard to the subject matter taught we boast of being well to the front in the race.

Education then is well abreast of the times. Our subject matter is reality; our method consists in doing things

with a view of gaining intellectual grip and power and getting into living relationship with the world around us.

In no country is education more universal or extensive than in our own, but in no direction are we yet perfect, and we have much to learn. What then of the future; what kind of men and women will the next generation produce?

Upon the subject of what ought to be taught, and the ways and means of teaching, we have much of value to learn, the learning and application of which will influence immeasurably the succeeding generation, in lighting and ventilating, particularly in city schools. Upon the proper care for the physical health of the child depends largely the growth of the mental faculties and abilities in the man.

The tendency in schools and colleges is towards education exclusively in the arts, sciences and languages, omitting the importance of how to care for the body. Teachers should be instructed more fully than at present as to the needs and conditions for the comfort of

children in the school-room. They surely ought to be more thoroughly informed, of the dangers resulting from neglect, ^{and} the remedies necessary to give assistance in avoiding evil consequences.

The public is becoming more enlightened upon these subjects ^{and} therefore attach more significance to them; but in large cities they are neglected ^{and} often ignored.

In country ^{and} town schools there are no such crowded conditions as may be observed in the school-rooms of some of our largest ^{and} most enlightened cities.

Besides the former have plenty of out-door space while the latter are hemmed in on all sides by factories, tenement houses ^{and} sky-scrapers, excluding sunlight ^{and} fresh air. Such a location necessarily requires the rooms to be artificially lighted; ^{and} the poorest ^{and} cheapest lights - gas-lights - are invariably used. Under such conditions pupils cannot give their whole attention to their studies; the strain on the eyes resulting from insufficient light detracts from the work ^{and} the power of concentrating the mind is weakened.

The eyes soon become fatigued causing dullness, drowsiness, a longing to escape from the dungeon-like school-room to the open air. Scholars confined to rooms of this description six or seven hours each day, five days of the week will soon become puny and worthless, incapable of study without suffering from weak eyes, resulting in many diseases peculiar to the eye and too frequently total blindness.

The worst light is from directly in front, subjecting the eyes both to its glare and the strain from the application to books. Lights placed in such relation to the position of pupils cannot well be avoided if artificial lighting is employed; and here we find a beginning of the serious results following poorly lighted school-rooms. Light coming from the right is also to be evaded if possible; particularly for writing the direction from which light is admitted must not be neglected. It should not, for the convenience and comfort in position, cast shadows from the hand or pencil thus bringing extra exertion and pain to

the eyes ^{and} detracting from the work before them.

The best source of light is from a high point to the left of the pupil striking at a wide angle. However, in rooms used only for recitation the direction of the entrance of light is not of such great importance as in rooms where children write ^{and} study.

School-rooms should not exceed fifteen or sixteen feet in height ^{and} the windows ought to be as high as the ceiling will permit. To admit sufficient light in the school-room the windows collectively must be at least one fifth ($\frac{1}{5}$) of the floor space, ^{and} many estimate that one fourth ($\frac{1}{4}$) is low enough. Surely even more would do no harm. There is a tendency in the construction of school buildings to make the rooms larger than they should be. No pupil ought to be seated for study more distant from windows than one ^{and} one half ($\frac{3}{2}$) the height of the window. That is, - if the windows are fourteen feet high, twenty one feet is the limit of distance

at which any child should be compelled to study. Further than this light will not penetrate with sufficient brightness to allow the continuous application of the eyes without danger of injury, especially in cases of children with weak eyes or a predisposition in that direction.

The teacher should study the scholars and seat them if possible where each one will be the most comfortable, particularly with regard to the effects of light on their eyesight.

Among other items of construction, and one that might attract more attention with good results, is the position of blackboards with reference to light. In almost every instance they are arranged around the walls without a thought as to whether or not the arrangement is a judicious one. And the walls really seem to be the only place for them as far as convenience is concerned, but they may at least be placed to receive proper light, leaving those portions vacant which are dark or receive but little light.

School houses in large cities like New York, Chicago, Pittsburgh and others, hemmed in on all sides by buildings that shut out the sun's rays, cannot be lighted otherwise than artificially. The place where children ought to be glad to go, that should bring happiness and pleasant memories to them, is more like a dungeon from which they are only too glad to escape.

No trick of construction can bring cheer and brightness into a school-room as sunlight and pure fresh air in abundance.

The public in general give too little attention to the physical welfare of children and scientific investigation and progress have much to answer for in bringing about this state of carelessness.

A person whose eyes are weak, abnormal, or diseased can be fitted with glasses by means of which he is enabled to see with the ease and distinctness of one possessing healthy eyes.

On the strength of this the tendency with many is to neglect until it is impossible or at least impracticable to let the sight go uncared for any longer,

Then they turn to the optician for relief. Among a large number of pupils, ranging in grades from primary to high school, it was ascertained by examinations that in large cities about one in eight have some diseased condition of the eyes; while in rural districts and towns the percentage is scarcely one fortieth that number.

This question and what are the remedies is of vast importance to the present generation and the solution of the problem will effect in a marked degree the ones to follow. The people must be educated, to recognize the dangers of this neglect, and aroused to the fact that they are the ones to bring about reform: it is only by their continual demands that this may be accomplished.

In connection with poor light in the school-room, because the two conditions are almost always associated together is, the much greater important subject of ventilation. When artificial lighting is employed the school buildings are packed in between other buildings

Thus excluding sunlight ^{and} preventing the free circulation of pure air either inside or outside.

Of all classes of buildings in the United States probably none are so unsatisfactorily supplied with wholesome atmosphere as public schools, ^{and} there is no other class of buildings that should require more attention to this demand.

Its importance to the health ^{and} mental growth ^{and} development of children cannot be overestimated.

Perfect ventilation exists only when the air in a room is the same as that outside; this condition is seldom or never secured nor is it even sought for. Good ventilation is all that is necessary ^{and} consists in having only a small amount of impurities in the atmosphere to be inhaled; that is in such small quantities that a person entering the room from the outside would experience no difference between the two places. It is impossible to secure good ventilation without considerable expense for the necessary apparatus, construction

and maintenance thereof. Much, of course, depends upon climate and the different seasons of the year; the expense being less in warm climates and mild seasons for the reason that plenty of fresh air may be admitted to the rooms through open windows without discomforts to the occupants, thus dispensing with the use of other ventilating apparatus.

It is not only essential to admit fresh air into a room, but also exits for foul air must be furnished; and that in such a manner as will cause no injurious draughts. Poor ventilation should be as carefully avoided as exposure, both being the cause of the origin of many diseases.

There is no absolutely normal condition of the atmosphere; it varies with locality and different climates. However, it must contain two essential elements, oxygen and nitrogen, for the support of life, and it always contains carbon dioxide and water.

The average amount of carbon dioxide is about .0004 but larger amounts may be present in the air without producing

serious results or even inconvenience. Not more than .0008, however, is allowable for continual respiration. In some city school-rooms the air has been found, by testing, to contain as much as .0072 of carbon dioxide, this being an exceedingly large quantity ^{and} harmful to persons living in ^{the} breathing such foul atmosphere.

There are many other impurities in expired air in the form of gases.

These may be classed as actively ^{and} negatively poisonous. The former are those which will cause death such as sulphuretted hydrogen; the latter will not sustain life but do not produce fatal results for example carbon dioxide.

Since carbon dioxide is not really dangerous to life why then is so much importance attached to its presence in the air ~~to~~ be inhaled? When carbon dioxide is present in large quantities the atmosphere is poor in oxygen, the most essential element for the sustenance of life.

The effects of this gas upon the system are easily recognized ^{and} are of common experience. It produces

dullness, drowsiness, ^{and} headache; there is a disagreeable sensation of oppression ^{and} contraction of the chest.

No one possessing a reasonable amount of intelligence will doubt for a moment, that a room containing air with impurities producing the above results, is highly injurious ^{and} dangerous to the health ^{and} progress of children. The presence of Carbon dioxide is easily detected ^{and} measured; thus affording an index to the quantity of the more harmful ^{and} fatal gases present.

Exhalations from the body, the source of several of these gases, diminishes circulation, increases respiration, causes confusion ^{and} oppression. Atmospheric air that has once entered the system ^{and} performed its work, should no more re-enter the body than any other material destined to build up the ever wasting tissue ^{and} to preserve health ^{and} energy.

The want of wholesome food for the lungs is the cause of many diseases, much ill health, weak constitutions ^{and} premature death.

Many of the fatal epidemics, that have taken away thousands of lives before its destructive ^{course} was checked, may be traced directly to the effects produced by improper ventilation.

We listen to ^{and} read with horror the stories of sufferings ^{and} deaths caused from such incidents as the imprisonment of the English in the Black Hole of Calcutta, where men perish from suffocation, for want of a breath of fresh air.

We read of these things ^{and} our indignation is aroused; but we never give a thought to the suffering around us from similar causes. To be sure the immediate effects are less startling, but they are more universal in extent ^{and} ultimately the results are vastly more disastrous.

School buildings should certainly be so situated as to give generous open space on every side; this is essential to the health ^{and} contentment of the school children. There should be good commodious play-grounds so that pupils will not be driven into the streets

there to learn the vices ^{and} tricks of city life, nor into dark dingy halls to find what pleasure they may during their release from study.

As to rules ^{and} plans for ventilating, none can be stated that will apply to any ^{and} all buildings in any locality or climate. These questions should be subjects of especial interest for study ^{and} investigation by the architect ^{and} builder, with reference to the cost ^{and} other circumstances that may bear upon the construction of the building. That the effect of climate in securing good ventilation ^{and} that its influence upon the growth, development ^{and} vigor of children, is considerable may easily be demonstrated by the observation of facts.

The city of Oakland, California, has a remarkably even yearly temperature, varying but a few degrees. During the different seasons. The school buildings are admirably located ^{and} the mildness of climate admits of ~~free~~ ventilation the greater part of the time.

Six thousand school children measured ^{and}

weighed there were found to be taller, heavier, further advanced relatively to their ages and free from disease than children in large eastern cities. Certainly the climate is not more invigorating in this city than elsewhere. Our largest, strongest and most energetic men and women boast of New England as their birthplace; and strange as it may seem the weakest men and women are reared in the cities of these same states.

What influence then has the unlimited supply of pure, wholesome air in securing the best results towards physical and intellectual growth and the fullest development of every faculty and ability in the youth? The question will doubtless be answered by different people in many ways, according to the knowledge they possess of the evils following neglect, the importance attached to it and the consideration that is deemed worthy to give the subject and the regard they have for the welfare of children. No iron clad rules or principles can be laid down as absolute to be invariably followed in all localities and all descriptions of buildings.

Many conditions will modify them.

The architect and builder have much to accomplish towards securing better ventilation.

It is their duty not only to study and investigate these things, advise and propose satisfactory appliances and suitable construction, but also to refuse to do any business with persons or committees who will not be convinced of the necessity of supplying wholesome atmosphere to the pupils in public schools. Much of the needed reform must come through their influence and advice. Scientific men may aid greatly in educating the people to the recognition of the fact that, for the most complete development possible of the intellectual powers, children must be surrounded with the greatest number of favorable circumstances that can be obtained.

One of the greatest difficulties in securing proper sanitary conditions is the inertia of those who should be the most interested, namely, the public.

It is only in times of epidemics or plagues that people are aroused and exert themselves to enforce better sanitary conditions.

They are themselves in danger during such times; their own life is threatened, they become interested immediately (in their own behalf).

It is a deplorable fact that in the city of New York, which expends upwards of \$20,000,000 annually for municipal government, the Board of Education cannot procure sufficient school funds to supply lights and ventilation where needed and space for playgrounds.

Children compelled to endure the effects produced by foul air and darkness are apt to become either dull or wicked.

There is that which detracts from study, unfits the mind for concentration upon any subject, a desire to escape from these conditions, a longing to be free and breathe invigorating atmosphere into the lungs.

There are many methods of ventilating buildings, varying widely in expense and efficiency. The basis for all plans and specifications for apparatus depends upon locality, the size of the building, the number of occupants and, the most important factor, the amount of air to be supplied.

Those who have investigated ^{and} ascertained through experiment the amount of air taken into the lungs, for a given time ^{and} the amount of impurities exhaled, give 2000 cubic feet per hour for each person as the minimum supply necessary to maintain comfort ^{and} health.

This calculation is intended to apply to adults; but children should have nearly or quite as much fresh air as grown persons. They are more susceptible to ^{and} more easily influenced by the impurities in the air ^{and} consequently the supply must not be stinted.

Many think that a much smaller quantity is sufficient for ordinary conditions. They seem to argue from the standpoint that anything is tolerable that is tolerated.

We should avoid electing such men for members of School Boards. They do more harm than good.

It has been estimated that \$1,3,000,000 would, with judicious application, purchase enough space so that each school in New York City not so supplied could be furnished with play grounds.

This, compared with the expenditure for city government, is a small amount, yet it would be a long stride towards securing better sanitary requirements in the school-room and creating more cheerfulness and energy among the pupils.

Of the numerous methods used for the ventilation of buildings one of the most satisfactory is by means of flues and registers. The register should be large enough to admit a sufficient quantity of air without causing uncomfortable draughts. They should not be placed flush with the floor as particles of dust and dirt will fall into them and be returned with the ascending air and breathed into the lungs, thus causing irritation, unpleasant coughing and general discomfort.

Modern French Engineers, and others, advise that the fresh air supply be introduced near the ceiling, which, being far above the occupants of the room, prevents unpleasant currents; while the discharge openings should be situated in the wall opposite the fresh air openings and as far from them as possible.

A fan is used in the basement, or wherever the source of admittance may be, to force air into the flues increasing the supply without the expense of putting in larger registers and a greater number of flues.

The flues should not be less than four or six inches in diameter; the number will depend upon the amount of air to be supplied and the velocity with which it is introduced into the flues.

During cold weather it becomes necessary to heat the air before using and thus another difficulty is encountered, namely, increased expense for heating and how to heat the air.

This involves another important consideration of "Heating Buildings": and is intimately associated with ventilation.

The amount of moisture in the atmosphere must not be overlooked.

In warm weather when the atmosphere is excessively charged with moisture a sensation of languor is experienced; while if there is a paucity, a sensation of dryness in the throat and bronchial irritation is the result.

This difficulty, however, is easily overcome, especially if the air is heated, by the use of steam introduced with the ascending air.

This system of ventilating wherever employed seems to give satisfaction, but it is only one of many. A detailed discussion of even one system would furnish material for a separate paper of considerable length.

As an economic problem, bearing on the future, these subjects are worthy of much thought and attention. Our courts, jails and penitentiaries are ever crowded with criminals of every description, which entails an enormous expense upon the Government for their prosecution and maintenance while imprisoned. All of this expense necessarily falls upon the people, increasing the burdens of taxation and decreasing the measure of pleasures which they should be allowed to enjoy.

By far the greater number of criminals to-day were torn and brought up among the vices of city life; perhaps their school days were passed in dark, poorly

ventilated rooms under influences tending to dwarf the whole being, physical intellectual and moral.

I believe that if the comforts of children were given more thought and careful consideration by parents; if the school days were made brighter by pleasant surroundings; if teachers were more thoroughly instructed as to the physical wants of children; if School Boards and Boards of Education were more energetically interested and more enthusiastic in their demands, we would see a radical change, a needed reform in the generations to come. This reform can be accomplished only through the efforts and demands of parents and society in general.

While we educate in the arts, sciences, literature and languages, our knowledge of how to live and enjoy life, the physical and sanitary conditions necessary for a long, happy and useful life, are singularly neglected.

We boast of living in a larger, better and wiser world than our fathers: yet, do we live longer, are we stronger,

do we enjoy life more? We need to be aroused to a lasting activity, not an evanescent one; an activity that will never waver in its efforts towards securing the necessities in schools for promoting the welfare of children; an activity that will devote fortune if need be for the happiness of those who are to fill our places in the years to come.

Society will demand then, and the demand will be granted, that more favorable conditions shall surround the boys and girls at school.

They will have the glow of health and contentment upon their faces instead of the pallor, sullen, careworn expression that now characterizes the average child in public city schools, confined to a place little better than a dungeon and a much worse place, more injurious to the health than the criminal is given in the penitentiaries.

Expense should be but an incidental consideration when discussing the construction of school buildings and the apparatus for securing favorable sanitary requirements.

Too frequently cost is the only consideration taken into account.

Such evils cannot long prevail if the public learn the dangers resulting from them. They will be aroused to that activity so much needed and a reform will soon be the result.

When this reform has been accomplished; when more elevating influences surround the schools; when society becomes aroused and push forward their claims and requirements, then we will have a race of men strong in body and soul, brave and true in adhering to their convictions, energetic in every action, holding in the highest degree of reverence the supreme laws of God and nature.

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