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Presentation of an environmental reference source for architects and designers includes separate listing of 19 short overview articles and 43 documents with an implicit specification orientation toward classroom lighting. The major document content areas are--(1) general specification guides with some psycho-physiological background, (2) evaluation of human responses to various environmental aspects, (3) mechanical system evaluations, (4) control of a specific aspect of the luminous environment, and (5) environmental rating systems. (Author)

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THE LUMINOUS ENVIRONMENT OF THE CLASSROOM

A selected and annotated bibliography

Prepared by
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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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I N T R O D U C T I O N

The primary function of this bibliography is the provision of a comprehensive reference source for the use of both architects and designers. The selection of individual sources is based entirely on the fulfillment of the needs of those two professions. While a great deal of research exists with respect to technological and purely physiological response data, it was felt that references which correlated both types of information and withdrew meaningful conclusions would be most valuable to the specified users.

The scope of this bibliography is such that it may be used on two different levels of subject approach. The first, and more general, consists of documents which represent relatively short overviews concerning the development or state-of-the-art of the classroom's visual environment. This section would primarily serve the functions of topic orientation and familiarization for both professionals and school administrators. The second group of references is concerned with more specific data. These sources consist of articles, manuals, and books which specify various conditions of the classroom's luminous environment which tend to elicit those physiological responses conducive to optimum performance of educational tasks. In some cases these are direct recommendations and environmental specification lists, while others concentrate on a specific aspect of psycho-physiological response and elaborate on those conditions which intensify or decrease such behavior. The various subjects, all of which have a direct relationship to the actual design or renovation of classrooms by the professional groups that this bibliography is intended for, can be divided into several content emphasis areas:

1. General specification guides with some psycho-physiological background

2. Evaluations of psycho-physiological responses to individual environmental aspects

3. Product, implement, or system-oriented sources which evaluate or discuss the provision of specific environmental amenities

4. Sources describing the control of a specific aspect of the luminous environment

5. References representing systems of rating or evaluating a classroom's luminous environment.

Source annotation has been included to facilitate the user's grasp of the essential focus of a particular reference. Determiniation of content and contemporary applicability character should be made through examination of document length and publication data. It might be emphasized that each reference was selected on a basis of informative usefulness and the strength of its relationship to contemporary thought and practice. Articles without annotation represent sources unobtainable to the bibliographer and are included for their potential applicability.

C O N T E N T S

D O C U M E N T

A V A I L A B I L I T Y

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S E C T I O N

1

ORIENTATION DOCUMENTS REPRESENTING SHORT OVERVIEWS REFLECTING THE DEVELOPMENT OR CURRENT STATE OF THEORY & PRACTICE IN CLASSROOM LIGHTING

1. Allphin, W. "Better Light for Better Learning," American School and University, 36 (June, 1964), 24-25.

2. Barden, C. R. "Factors of Vision in the School Environment," Sight-Saving Review, 30 (Spring, 1960), 25-32.

Factors which influence visual comfort and efficiency such as brightness ratios, ceiling design, and glare are discussed.

3. Barthelme, D. "Top Lighting Is Here to Stay," American School and University, 1956-57, (1956), 193-200.

Examples of the use of controlled top lighting are used to justify its advantages. Photographs and statements by administrators and architects support these.

4. Burnham, R. D. "New Lighting Concepts for New Schools," American School Board Journal, (December, 1956), 31-32.

Concepts of control in preference to quantity, spatial flexibility with luminous ceilings, and high frequency source systems are emphasized.

5. Clapp, Wilfred F. "Teaching, Learning, and Lighting," Illuminating Engineering, 57 (April, 1962), 316-318.

Fundamental planning principles for elementary and secondary schools are stated in conjunction with contemporary lighting trends.

6. Collins, G. J. "Providing Optimal Classroom Environments within Fiscal Limitations, or Windowless Schools." In Proceedings of the Association of School Business Officials of the U. S. and Canada. Chicago: Association of School Business Officials, 1962. Pp. 224-226.

7. Darby, F. C. "Progress in School Lighting," American School Board Journal, 142 (January, 1961), 33.

The development of concept emphasis is traced to the present state of providing environmental standards with imaginative flexibility.

8. Daum, H. F. "Some Reasons for Opposing the Trend to Windowless Schools." In Proceedings of the Association of School Business Officials of the U. S. and Canada. Chicago: Association of School Business Officials, 1962. Pp. 224-226.

9. Evans, Ben H. "Daylighting a School, Indoors and Outdoors," Illuminating Engineering, (October, 1962).

An example of a school design in which integration of interior and exterior skylights supplemented conventional daylight illumination.

**10. Gibson, Charles D. "How to Rate Your School Lighting," Nation's Schools, 74 (October, 1964), 53-54. EF 001 054

An overview of the progress of vision engineering, adaptation to new educational trends, and innovations in building systems and components.

**11. Gibson, Charles D. "School Lighting - 20 Year Progress Report." In Eric Pawley, ed., AIA School Plant Studies, A Selection 1952-1962. Washington, D.C.: American Institute of Architects, 1962. Pp. 94-96. EF 000 925

Review of concept development, including contributions of important institutions and sponsored studies. Goals established through these studies are listed, along with general conclusions reached.

12. Harmon, Darell B. "Exploding the Classroom Footcandle Myth - Part I: Are We Confusing Eyes with Vision?" School Planning, 2 (March, 1957), 7-9.

**13. Illuminating Engineering Society. "The Luminous Environment for School Children," American School Board Journal, 146 (March, 1963), 29-30. EF 001 024

Emphasizes design for task orientation and light quality through principle outlines.

14. Jones, B. F. "Basic Understanding of School Lighting," Catholic School Journal, 61 (September, 1961) 111-13.

15. Marschall, J. "Questions on School Lighting," Catholic School Journal, 58 (January, 1958), 41-42.

16. McDonald, E. G., and E. Burts. "Opinions Differ on Windowless Classrooms," NEA Journal, 50 (October, 1961), 12-14.

    Various positive and negative viewpoints from teachers, administrators, and architects are presented.

**17. Pawley, Eric. "School Lighting - From an Architect's Viewpoint." In Eric Pawley, ed., AIA School Plant Studies, A Selection 1952-1962. Washington, D. C.: American Institute of Architects, 1962. EF 000 925

    Discussion of definitions, goals, and directions involved in the integration of lighting into a total environment.

18. Seagers, Paul W. "Lighting the Classroom," NEA Journal, 51 (October, 1962), 30-31.

    General guidelines for creating and maintaining a proper visual environment are presented.

19. Wakefield, George P. "Why Design for the Best in Classrooms?" Illuminating Engineering, 45 (May, 1950), 277-278.

    Difficulties in achieving proper standards of illumination are discussed with respect to specification and construction.

SECTION

2

DOCUMENTS RELATED TO THE SPECIFIC DEVELOPMENT, JUSTIFICATION, OR QUESTIONING OF ENVIRONMENTAL STANDARDS OR GUIDELINES FOR CLASSROOM LIGHTING

1. Acuff, W. T. A Study of the Visual Environment in Selected Classrooms. Unpublished Doctoral Thesis. Knoxville: University of Tennessee, 1962. 243 pp.

Appraisal of illumination factors from thirty surveyed classrooms in ten schools according to established standards.

2. Allphin, Willard. "School Lighting and Posture," Illuminating Engineering, 49 (April, 1954), 192-196.

Lack of substantive correlation between illumination and posture is demonstrated through photographic observation of children under "normal" postural conditions.

3. Allphin, W. "Sight Lines to Desk Tasks in Schools and Offices," Illuminating Engineering, 63 (April, 1963), 244.

Investigation and interpretation of data concerning visual angles and associated glare reduction information.

4. American Standard Guide for School Lighting. New York: American Standards Association, 1962.

Comprehensive definition of concepts, requirements, and principles with suggested quantities and qualities for various educational tasks. Includes bibliography.

**5. Better School Lighting - A Condensation and Interpretation of the New 40 Page "American Standard Guide for School Lighting." Louisville: Thomas Industries, Inc., Benjamin Division. 3 pp. EF 000 973

Needs, factor variables, recommended energy levels, and design of systems are covered.

6. "The Birth and Development of School Lighting," Illuminating Engineering, 51 (January, 1956), 36-46.

The history of illumination standards is traced through documentation of influences and pictorial evidence. Current recommended standards are illustrated and discussed.

7. Caudill, William W. Toward Better School Design. New York: F. W. Dodge Corporation, 1954. 271 pp.

   Chapter Three emphasizes the behavior of natural and artificial light within the classroom. Integration of lighting and other architectural systems is illustrated in numerous examples.

*8. Classroom Lighting. New York: National Society for the Prevention of Blindness, Inc., 1963. 14 pp. EF 001 444

   Defines concepts and light levels, recommends proper levels and installation characteristics, and defines role of the teacher in maintaining proper visual environment.

**9. Crouch, C. L. "Better Lighting through Research," American School and University, (May, 1966), 47-48. EF 000 451

   Research-based evolution of new standards of illumination levels based on reflectances and glare elimination.

10. Early, Doyt. "Glare Control in Schools," Progressive Architecture, 36 (March, 1955), 118-126.

   Topic is discussed in terms of light levels, controls, contrasts, surfaces, and architectural configurations. Calculations for a renovation example are given.

11. Evans, Ben H. "Classroom Task Illumination as Affected by the Students and Their Attire," Texas Engineering Experiment Station News, (June, 1955).

12. Gibson, Charles D. "Recommended Approach to School Lighting Design," Sight-Saving Review, 24 (1954), 11-14.

   Goals and principles related to needs of the luminous environment are briefly outlined.

**13. Gibson, Charles D. "Today's Concepts in School Lighting," American School Board Journal, (June, 1965), 21-24. EF 000 463

   Important areas of development are briefly outlined. Principles of brightness balance, task specified, and measurement are emphasized.

14. Guide for Planning School Plants. East Lansing, Mich.: National Council on Schoolhouse Construction, 1958. 254 pp.

Discussion of the coordination of the visual environment with electrical services and lighting design is included.

15. Hammer, R. F., and L. E. Johnson. "Manufactured Light Vs. Daylight for Schools Rooms; With Discussion," Illuminating Engineering, 53 (July, 1956), 493-503.

Comparative evaluation is conducted in terms of construction, cost analysis, visual characteristics, and function. A discussion follows.

16. Hamon, Ray L. Lighting Schoolrooms. Washington, D.C.: U. S. Office of Education, 1948. 17 pp.

Describes techniques of brightness balance, color selection, and source selection. Proper use of natural and artificial lighting is discussed.

17. Harmon, Darell B. "Light on Growing Children," Architectural Record, 100 (February, 1946), 78-90.

Descriptions of stress attributed to improper conditions and a detailed case study of improvements to an existing daylit school.

18. Harmon, Darell B. Lighting as Flexible as Your Classroom. Vermilion: Wakefield Company, 1955. 40 pp.

The development of a flexible lighting system to conform to developed task lighting needs and standards.

19. Harmon, Darell B. "Principles and Philosophy of the Coordinated Classroom," Nation's Schools, 45 (March, 1950), 49-52.

General topics concerning needs, background development, design principles, and application of principles are discussed. Four examples of these applications to schools follow on Pages 53-68.

*20. Harmon, Darell B. The Coordinated Classroom. Grand Rapids, Mich.: American Seating Company, 1951. 48 pp. EF 000 308

Experimental verification of environmental concepts. Includes written and diagrammatic suggestions for proper control of natural and artificial lighting sources.

21. Harmon, Darell B. "Vision, Lighting, and Learning," School Planning, 1 (September, 1956), 6-18.

**22. "How Gibson's Wheel Measures Light," Nation's Schools, 74 (October, 1964), 55-57. EF 001 055

Evaluative system which rates characteristics of light quality, levels, equipment, maintenance, cost, etc.

23. "Illuminating Engineering Society," Illuminating Engineering, 48 (June, 1953), 291-348.

The entire issue is devoted to school lighting in terms of building goals, color selection, task visibility, economics, system characteristics, quality requirements, performance, and other specific applications.

24. Johnson, B. E. "Controlled Light for an Improved Environment," American School and University, 1958-1959, 30 (1958), 73-78.

The development for a luminous ceiling system is shown to provide an optimum environment consistent with economy. Intensity data studies of various classroom sections demonstrate the more even distribution characteristics of the system.

25. Kahler, W. H. "Visibility of Chalkboards for Classrooms," School Board Journal, (December, 1950), 47.

26. Kaufmann, John E., ed. IES Lighting Handbook; The Standard Lighting Guide. 4th Edition. New York: Illuminating Engineering Society, 1966.

Chapters 11-15 give recommendations for quality and quantity for various educational areas.

*27. Larson, C. Theodore. SER 2 Environmental Evaluations. Ann Arbor: University of Michigan, 1965. Pp. 186. EF 001 392

The chapter on the luminous environment and its effects on man (Pages 101-131) includes reviews on research and development in illumination, established standards of illumination quality and quantity, and problems of daylighting.

28. "Lighting for Low-Ceiling Classrooms," Illuminating Engineering, 54 (October, 1959), 651-654.

Definitions and methods of daylighting low-ceiling classrooms are presented through principles and related equipment.

*29. Manning, Peter, ed. The Primary School: An Environment for Education. Liverpool: The Pilkington Research Unit, 1967. 163 pp. EF 000 079

Chapter 1.5 concerns the visual environment with emphasis on daylighting. Other aspects receive conceptual review.

30. Moon, Parry H. and Spencer D. Eberle. Lighting Design. Cambridge, Mass.: Addison-Wesley Press, 1948. 482 pp.

General source with emphasis on technical requirement fulfillment.

31. "New Standards for School Lighting," Catholic School Journal, 62 (November, 1962), 67-69.

*32. Pena, William M. Predetermination of Natural Illumination by the Model Testing Method. Bryan, Texas: Caudill, Rowlett, Scott and Associates, Architects-Engineers, 1957. 4 pp. EF 000 429

A description of the process and equipment used for predetermination of quantities and characteristics.

*33. Reida, George W. Artificial Lighting for Modern Schools, A Guide for Administrative Use. Topeka, Kansas: State Department of Public Instruction, 1960. 44 pp. EF 000 002

Comprehensive guide for development of adequate standards of lighting quality, levels, and equipment selection.

**34. Sampson, Foster K. "Effects of Teaching Equipment and Supplies on Visual Environment." AIA School Plant Studies, A Selection 1952-1962. Washington, D.C.: American Institute of Architects, 1962. EF 000 925.

Research data concerning brightness and contrast is discussed along with general principles, techniques, and glare characteristics of various lighting systems.

**35. School Lighting. Cleveland: General Electric, 1964. 15 pp. EF 000 491

Effective lighting levels and procedures for various school plant areas, as well as classroom lighting procedures, are outlined.

*36. School Lighting Application Data. Excerpts from the IES Lighting Handbook, 3rd Edition. New York: Illuminating Engineering Society. 16 pp. EF 000 625

System characteristics, task performance requirements, and sample applications are presented.

**37. School Lighting Guide. Vermilion: Wakefield Lighting. EF 000 974

Explanation of proper lighting levels and characteristics is included with tips on economical maintenance.

38. "School Lighting Principles Applied to Design, Renovation, Maintenance," Nation's Schools, 66 (September, 1960), 75-100.

Eight articles describe principles, define terms, show research data and recommended criteria, discuss design principles and methods, and show administrative responsibilities. A number of architectural solutions to the classroom section are shown in diagrammatic form.

39. Seagers, Paul W. Light, Vision, and Learning. New York: Better Light Better Sight Bureau, 1963. 95 pp.

Presents strong background in physics, physiology, and perception. Includes illustrated principles, classroom environmental recommendations, glossary, and comprehensive annotated bibliography.

40. Seagers, Paul W. and G. Harold Hart. Functional Color for the Classroom. Chicago: Brunswick Corporation, 1958. 24 pp.

Describes treatment of equipment and interior surfaces for optimum educational performance.

41. Spencer, D. E. "Developments in Daylighting Schools Since World War II," American School and University, 1955-1956, 27 (1955), 397-404.

Emphasis is placed on the creation of proper environmental characteristics through use of proper sources, controls, surfaces, and materials. It was concluded that none of the daylighting methods satisfy the criteria for an optimum luminous environment for all lines of sight.

42. Tao, W. K. "Evaluation of Classroom Lighting Systems." In Proceedings of the Association of School Business Officials of the U. S. and Canada. Chicago: Association of School Business Officials, 1955. Pp. 341-355.

43. Wittich, W. A. "Putting Light Control into the Plans," Nation's Schools, 59 (February, 1957), 106-112.

Design techniques for audiovisual adaptability are discussed with emphasis being placed on the vision-strip classroom.