Experimental spaces outside the laboratory – Experiment kits and instruction manuals around 1900

Viola van Beek

In the late Eighteenth century, testing cabinets, household and travel laboratories became available for sale to anyone wishing to perform chemical analyses: to chemists, as well as doctors, factory owners, agriculturalists, traveling naturalists or lovers of chemistry and mineralogy. From early on, however, testing cabinets were also used by uneducated laymen. So-called "amusement chests" had been widely used in England since the first third of the Nineteenth century (Gee 1989) and also in Germany, chemical and physical experiments were overwhelmingly popular. Introductory experiment kits designed for such interested laymen were marketed for a broad target audience.

Nevertheless, experiment kits were not only used for traveling or stage performance and amusement; they were also teaching aids. In the late Nineteenth and early Twentieth century experiment kits were produced in order to provide access to experimental knowledge at schools as well as at home. These portable laboratories, as they contained not only precisely tuned instruments and other materials, but also school textbooks or instruction manuals, made it possible to learn theory as well as concrete, practical application. In this way, the kit and the book were closely linked with one another: the book was supplemented by the objects at hand and the kit by instructions in written form.

By referring to evidence in the form of teaching materials catalogues, instruction manuals, reviews etc. and exploring how the kits were invented, marketed and used, this essay attempts to depict the ways in which experiment kits, which had been designed primarily for children and teenagers, created and staged experimental spaces outside of the laboratory in Germany around 1900.

School experiments

In the last three decades of the Nineteenth century, experimental study of science in schools became increasingly important. The "Allgemeine Bestimmungen" [general regulations] of 1872 in Prussia were the first provisions to promote experimental science as a standard component of practical instruction in "Volksschulen" [common elementary schools]. This practice was particularly embraced in the "Gymnasien" [college preparatory schools] where the reform of 1882 expanded instruction in the natural sciences and mathematics while scaling down instruction in the ancient languages, orienting curricula along the lines of those in the "Realschulen" [secondary schools] with a focus on the natural sciences. Official orders demanded that the classrooms be equipped with apparatus and teaching aids; furthermore, instructions were published on how to conduct experiments and construct devices (Frick 1872).

This development applied mainly to physics and chemistry, however as the natural sciences continued to gain recognition in schools, especially in the reformed curricula developed after the turn of the century, other types of experiments, for example physiological experiments were carried out as well. Dead matter for use in identification exercises and microscopic investigations was provided by companies selling natural produce and teaching material. However, because few lecturers were familiarized with physiological experiments over the course of their education and because teachers are reported to have experienced "a much high number of failures" than with chemical and physical tests, instruction in physiology was mostly limited to theoretical descriptions (Höller 1908, 388). In 1913 and 1914, Carl Schäffer and Ludwig Spilger attempted to bridge this gap with *Instructions on the independent study of living phenomena for young naturalists* [*Anleitung zum selbsttätigen Studium der Lebenserscheinungen für jugendliche Naturfreunde*] and a *Biological Experiment Kit* [*Biologischer Experimentierkasten*] (Schäffer 1913; Spilger 1914), but it was not until the 1920's that biology courses became a standard part of the advanced classes of secondary education.

At lower-level schools, cabinets were known for their poor equipment and sometimes haphazard construction and the teachers who used them for their deplorable lack of skill, even though one of the general principles regarding the use of experiments in schools as reported in an *Experiment Book for Instruction in Natural Studies* [*Experimentierbuch für den Unterricht in der Naturlehre*] written in 1898 reads as follows: "every test must succeed" (Rosenberg 1919, 47). Experiment demonstrations required sufficient practice and good preparation as well as an exact attention to the proper conditions so that they ensure that each phenomenon could be demonstrated successfully at any given time, forming the basis for empirical science in the classroom.

Fig. 1.: Haupt-Katalog (Jubiläums-Ausgabe) der Leipziger Lehrmittel-Anstalt von Dr. Oskar Schneider [publ. approx. 1902] (Detail).

Prepackaged experiment kits together with a manual addressed this problem. Such kits, tested to ensure successful use, were produced by the "Leipziger Lehrmittel-Anstalt" and the Dresden-based company "Meiser & Mertig". In acknowledgment of the reformation of the curricula and the development of school-specific cabinets and laboratories, teaching aid producers and precision mechanics workshops also began to model themselves to address these new requirements: using catalogs, e.g. Meiser & Mertig's Sammlungen physikalischer Apparate (1897) and the Haupt-Katalog der Leipziger Lehrmittel-Anstalt von Dr. Oskar Schneider (1902), and permanent and multi-regional exhibitions, they presented economical mass-produced devices as well as customized goods for use in practical instruction.

Fig. 2: Collections of devices for the experimental study of science [*Großer physikalischer Apparat*]. In: Haupt-Katalog der Leipziger Lehrmittel-Anstalt von Dr. Oskar Schneider, approx. 1902, 227.

Meiser & Mertig was founded in 1883 by a physicist and a mechanic and the Leipziger Lehrmittel-Anstalt was founded in 1887 by the microscopic science institute of Oskar Schneider and August Tietz. When choosing which instruments to produce, the manufacturers referred to well-known books widely in use in school instruction such as the textbooks of Müller-Pouillet, Weinhold or Stöckhardt and articles in the *Zeitschrift für physikalischen und chemischen Unterricht* [*Journal for Instruction in Physics and Chemistry*] established by Friedrich Poske in 1887 (Haupt-Katalog der Leipziger Lehrmittel-Anstalt 1902, 13; Meiser & Mertig 1910, IV). However, manufacturers also produced collections for institutions for higher education such as Meiser & Mertig's *Sammlungen von Apparaten zum experimentellen Studium der Physik* [*Collection of devices for the experimental study of physics*] (optics, acoustics, galvanic electricity and static electricity), complete with exercise assignments or Dr. Schneider's *Großer Physikalischer Apparat* [*Large-sized collection of physical devices*]. Smaller collections like Dr. Schneiders *Small-sized collection of physical devices*, designed for elementary and public schools were tailored to the requirements of simple use in schools.

Fig. 3: Collections of devices for the experimental study of science. [*Sammlung von Apparaten zum experimentellen Studium der Physik*]. In: Meiser & Mertig's Sammlungen physikalischer Apparate, 7th ed. 1897, 11.

These collections could be ordered in different sizes and expanded at any time by making additional purchases. Therefore, their claims to include all the basic laws relevant to the individual areas of instruction were influenced both by buying power and by the different educational institutions. Both companies emphasized the easy handling of the devices facilitated by their small size, the ease of installation and use and the versatility of the equipment. Thanks to the "considerations made for smaller spaces," be those spaces limited by the curriculum or the size of the room, the devices could be stored effectively, set up on the smallest of school desks and the experiments carried out quickly and efficiently: "when each part has its proper place, these elements can be set up within a minute" (Meiser & Mertig 1897a, 6).

Home laboratories

The requirements for complete instruction in experimentation were not limited to the laboratories and school desks. Individual work was expected outside of the classroom and students were encouraged to experiment at home and manufacture their own equipment (Baenitz 1883, 303). In addition to the collections designed for school instruction, Meiser & Mertig and the Leipziger Lehrmittel-Anstalt therefore offered experiment kits for home use.

Fig. 4.: "Experimentirkasten Physik" (Meiser & Mertig). Point your mouse to the image to get an impression of the corresponding instruction manual: Meiser & Mertig, eds. 1895. Physik. 400 Versuche aus dem Gebiete der Mechanik, Akustik, Wärme, Optik, Elektricität. Uebungsbuch für den Experimentirkasten. 4th ed. Dresden: Selbstverlag.

Even in the smallest of spaces, these kits and their precisely tuned instruments could transform any table into a small laboratory. Under the names *Der praktische Chemiker* [*The practical chemist*], *Der praktische Elektriker* [*The practical electrician*], *Der praktische Mikroskopierer* [*The practical microscopist*], *Experimentierkasten Magnetismus* [*Magnetism experiment kit*] (Leipziger Lehrmittel-Anstalt) or *Experimentirkasten 'Physik'* [*'Physics' experiment kit*] (Meiser & Mertig), these kits were advertised both in corporate catalogs as well as in brochures, depicting well-dressed boys wearing a suit and white shirt, or in newspaper inserts, for example as the ideal Christmas gift.

These home experiment kits brought magnetism, static electricity or mechanics to children and teenagers in manageable forms of chemical, physics and particularly electrical experiment sets with precisely calibrated parts and tested experiments. While previous knowledge was required to successfully complete the exercises using the larger collections designed for instruction in class, the experiment kits for use at home were designed to be "as simple as possible" in order to preclude detours, false conclusions and failures (Meiser & Mertig, 1895). The young experimenter did not need to consult a textbook; he or she was given the explanation for the phenomenon after each experiment.

But even when the devices in the kit were correctly constructed – "if a test does not succeed immediately, the cause must lie in the student himself and not in the devices [...]" (Meiser & Mertig 1897a, 9) – it was the difficulties that arose from using the kit, the imponderability and intricacy of the devices and materials that actually provided the knowledge gained from experimentation. The manual for a rather curious object, an x-ray experiment kit produced by the Leipziger Lehrmittel-Anstalt, states: "Now we move on to photographing using x-rays. Very simple! Fig. 69 shows the experimental setup, which is clear without further explanation." However, as the following text admits, nothing is clear "without further explanation": for example, the proper exposure time cannot be determined without taking a number of conditions into account, such as the quality of the pipes or the size of the machine; these things can only be determined by trial and error (Schulze 1913, 44).

Fig. 5.: Illustrations taken from the manual for the x-ray experiment kit produced by the Leipziger Lehrmittel-Anstalt. Schulze, Richard. 1913 [1909]. Elektron. 104 Schülerexperimente aus dem Gebiete der Elektrizität, 4th ed. Werdau: Julius Booch: 44-45.

In this sense, manuals were not merely a written exposition of the knowledge gained by experimentation, but rather do-it-yourself instructions. The practical experimentation, instrument setup and handling as well as the handling and use of the ingredients and materials used were seen as tasks that had to be practiced and tested independently of the text and pictures in the instructions. It was in the act of the experiment, the finely attuned coordination between the experimenter and his setup rather than in the phenomena itself that the experimenter found the key to understanding the knowledge gained by experimentation.

Kosmos kits

Self-experimentation in the form of student experiments in the natural sciences took on increased importance around 1900. Especially over the course of the work school movement ["Arbeitschulbewegung"], the bid for the self-governed student experiment was supported with renewed vigor. The work school, which placed special value on the independence of the children, encouraged students to build their own devices and experimental equipment for use in class (Retter 1979, 170-182). Instead of using purchased equipment to demonstrate natural phenomena, the students where meant to develop an appreciation for the basics of natural science through their own handicrafts. Craft instruction ["Handarbeitsunterricht"] had taken on a greater importance as a subject in elementary schools since the turn of the century although its integration into the curricula of secondary schools was criticized as one-sided and exaggerated emphasis on manual work. The work school ideology responded with the claim that manual crafts were very important to general cognitive processes: they were neither to be understood as opposed to intellectual work nor as primary forms of expression, but as tools to aid in discovery which, in this light, possessed educational value as "self-instruction" (Pabst 1910/1911, 164; Hermann 1930, 95).

This principle of constructing the devices by oneself served as the basic design principle for the Kosmos kits built by the Franckh'sche Verlagshandlung, In 1903, the owners of the Franckh'sche Verlagshandlung, Euchar Nehmann and Walter Keller, founded the society "Gesellschaft für Naturfreunde" in an effort to bring laymen interested in education and nature closer together and to provide them with valuable information about nature and the natural sciences. By 1904, they had established "Kosmos. Handweiser für Naturfreunde," a monthly journal for the society in which also experiments were presented and discussed.

In the 1920's the first experiment kits were produced in the company's teaching aid department under the direction of the Swiss teacher Dr. Wilhelm Fröhlich (1892-1969). Fröhlich, who had studied physics and chemistry in Geneva and Bern, became a permanent employee of the Franckh'sche Verlagshandlung in 1920. Between 1921 and 1930, the firm developed the Kosmos-Baukästen *Electro* (1921), *Optics* (1923), *Mechanics* (around 1924/1925), *Chemistry* (around 1927) and *Radio* (1930). Later, the company went on to produce experiment kits for other subjects such as, for example, astronomy (around 1928), geometry (around 1928), agriculture (1936), microscopy (1936), biology (around 1935) and engineering (around 1937).

Fig. 6 and 7.: Kosmos experiment kits *Electro* (n.d.) and *Chemistry* (1930).
The kit *electro* is courtesy of the Deutsches Museum, Munich. The kit *chemistry* is courtesy of the Franckh-Kosmos Verlags-GmbH & Co. KG, Stuttgart.

Although these kits were designed for individual use, they were initially marketed as teaching aids, especially for work instruction at elementary and rural schools. In 1927, Wilhelm Fröhlich wrote a textbook tailored for use in work schools using the kits for *mechanics*, *optics*, *electronics* and *chemistry* (Fröhlich 1927). Simpler outfits, marketed as teaching toys [Lehrspielzeug], were developed in the 1930's and geared towards younger boys. These included the *Elektromann* (around 1930), *Optikus* (1933), *Technikus* (around 1935), *All-Chemist* (1932) and *Radiomann* (1934).

Fig. 8.: Kosmos "Elektromann" (5th edition 1934). Courtesy of the Franckh-Kosmos Verlags-GmbH & Co. KG, Stuttgart.

"[...] [P]hysics and chemistry are not learned from a book like a poem, but through practical experience" (NL Wilhelm HS 1978-43/3). The kits were meant to function as a complete laboratory; at the same time, they were equipped with very simple devices in order to ensure that the first tests did not fail because of the experimental setup being too complicated. Many different instruments could be constructed using only a few basic elements. In some cases, as in the example of the optics kit, the case itself took on the function of an instrument, for example a telescope, projection apparatus or microscope. In his notes about the new version of the optics kit, in which a round pipe similar to the routine optical instruments was to be included, Wilhelm Fröhlich writes that the square cut pipes composed of two connected halves which made up the storage case had been requested by the company at that time "on the one hand, to make the distances between the parts, more specifically the focal distances clear and on the other hand, to avoid the costs associated with rounded parts, for example mirrors and apertures" (NL Wilhelm Fröhlich HS 1978-43/1). At the same time, because the students used the same basic elements in experimental setups with different functions, they were meant to learn to trace these phenomena back to the same basic principles.

Fig. 9.: Kosmos experiment kit "Optics" (n.d.). Courtesy of the Deutsches Museum, Munich. Point your mouse to the image to see box contents. Included instruction manual: Fröhlich, Wilhelm. 1923. Anleitung zum Gebrauch des Kosmos-Baukasten Optik. 280 Versuche aus der Lehre vom Licht. Stuttgart: Franckh'sche Verlagshandlung.

These kits were to promote interest in the natural sciences by enabling the students to discover the most important phenomena and laws themselves using only the simplest of tests and devices. While it was still common practice at Meiser & Mertig to offer finished instruments such as the polarization device designed by Johann Gottlieb Nörremberg (Meiser & Mertig 1897b, 19), the optics kit and its components, such as lenses etc. enabled students to construct such devices themselves. Although these experiment kits were not cheap – in comparison with other toys, they were sometimes disproportionately expensive – they were hailed as innovative teaching aids. In 1937, the Franckh'sche Verlagshandlung won the gold medal at the World's Fair in Paris for their achievement.

When producing later kits, the Franckh'sche Verlagshandlung made a special effort to indicate that these kits were geared more towards a target audience interested in advancement and technology and that the kits offered learning opportunities which would lead their users to a career in a discipline which promised success. It his literary autobiographical description of the creation of the model steam engine in the *Technikus* experiment kit, Wilhelm Fröhlich describes two crafty young farm boys ("Once upon a time..."), one of whom reportedly went on to become a successful machine manufacturer and moved to Africa and the other, the real inventor of the two, never forgot "the excitement with which he had tinkered as a boy, how often tests would only succeed after several failures because nobody had given him the instructions" (NL Wilhelm Fröhlich HS 1978-43/10). Now, experiment kits provided these instructions and, as a result, – as I hope to have shown in this essay - specific experimental spaces in which one experimented or could experiment around 1900.

References

Primary Literature

Unpublished resources are courtesy of the archive of the Franckh-Kosmos Verlags-GmbH & Co. KG, Stuttgart and the archive of the Deutsches Museum, Munich.

Anonymous. 1876. Anleitung künftiger Lehrer der Physik zur Bekanntschaft mit den physikalischen Lehrmitteln und im Experimentiren während der Studienzeit". Zentralblatt für die gesamte Unterrichtsverwaltung in Preußen 18(7): 433-434

Baenitz, Carl. 1883. Der naturwissenschaftliche Unterricht in gehobenen Lehranstalten. Methodisch beleuchtet und mit Lehrplänen und Hinweisungen auf die hierher gehörige Litteratur und die geeigneten Lehrmitteln versehen. 2nd ed. Berlin: Bornträger

Bendt, Franz. 1896. Die neue Berliner "Urania". Die Gartenlaube 38: 632-637

Deutsche Lehrmittel-Anstalt, ed. 1892/93. Illustrierter Katalog No.2 über gefahrlose Dampfmaschinen: Modelle von Lokomotiven und Schiffen mit Dampfbetrieb. Elektrische, optische und physikalische Apparate sowie Experimentier-Kabinette in sachgemässer Zusammenstellung und solidester Ausführung als Unterhaltungs- und Lehrmittel für Kinder und Erwachsene. Frankfurt am Main: Deutsche Lehrmittel-Anstalt

Frick, Joseph. 1872. Die physikalische Technik oder Anleitung zur Anstellung von physikalischen Versuchen und zur Herstellung von physikalischen Apparaten mit möglichst einfachen Mitteln. 4th ed. Braunschweig: Vieweg

Fröhlich, Wilhelm. 1923. Anleitung zum Gebrauch des Kosmos-Baukasten Optik: 280 Versuche aus der Lehre vom Licht. Stuttgart: Franckh'sche Verlagshandlung

Fröhlich, Wilhelm. 1927. Kleine Naturlehre für Volksschulen. Physik- und Chemie-Unterricht im Sinne der Arbeitschule für einfachste Schulverhältnisse unter Benützung der Kosmos-Baukästen. 2nd ed. Stuttgart: Franckh'sche Verlagshandlung

Galton, Francis. 1892. Hereditary Genius: An Inquiry Into its Laws and Consequences. 2nd ed. London: Macmillan

Gebrüder Bing AG, ed. 1977. Spezial-Preisliste über mechanische. optische und elektrische Spielwaren und Lehrmittel. Nürnberg. Reprint of the 1912-1915 ed. In: Gebrüder Bing: Spielzeug zur Vorkriegszeit, 1912-1915. 2nd ed. Ed. by Claude Jeanmaire. Villigen: Verl. Eisenbahn

Geiger, Hans and Karl Scheel, eds. 1926-1933. Handbuch der Physik, 24 Bde. Berlin: Julius Springer

Herrmann, Fritz. 1930. Erkenntnisfördernde Handbetätigung im Sachunterricht. (Mit praktischen Beispielen aus dem technisch-physikalischen Unterricht). Die Arbeitschule. Monatsschrift des Deutschen Vereins für Werktätige Erziehung 44(1/2): 92-10

Höller, Konrad. 1908. Das physiologische Experiment im naturgeschichtlichen Unterricht. Pädagogische Reform. Zugleich Zeitschrift der Hamburger Lehrmittelausstellung 32: 387-390

Kerschensteiner, Georg. 1914. Wesen und Wert des Naturwissenschaftlichen Unterrichts. Neue Untersuchungen einer alten Frage. Leipzig/Berlin: Teubner

Kunkel, P. 1915. Experiment in der Schule. In: Lexikon der Pädagogik, 2. Bd. Ed. by Ernst M. Roloff. Freiburg i. Br.: Herder: 1186-1189

Leipziger Lehrmittel-Anstalt, ed. 1986. Der Jugend Spiel und Arbeit. Kriegsausgabe. Neuheiten-Verzeichnis von im Kriegsjahre 1915 erschienen Lehrmitteln, Beschäftigungs- und Gesellschafts-Spielen in sorgfältiger Auswahl. Leipzig. Reprint of the 1915 ed. In: Deutsches Spielzeug zur Kriegszeit (1915). Ed. by Jeanmaire. Claude. Villigen AG: Verlag Eisenbahn

Leipziger Lehrmittel-Anstalt, ed. 1878. Catalog der Leipziger Lehrmittel-Anstalt und permanenten Mikroskopischen und Lehrmittel-Ausstellung von Dr. Oskar Schneider. Leipzig: Selbstverlag

Leipziger Lehrmittel-Anstalt, ed. 1902, ca. Haupt-Katalog (Jubiläums-Ausgabe) der Leipziger Lehrmittel-Anstalt von Dr. Oskar Schneider. Leipzig: Selbstverlag

Meiser & Mertig, ed. 1888. Preis-Verzeichniss der physikalisch-technischen Werkstaetten Meiser & Mertig. Dresden: Selbstverlag

Meiser & Mertig, ed. 1894. Physik: 40 Dispositionen für die wichtigsten Lehrstunden der Physik: Praktisches Handbuch für das Physikalische Kabinett. Dresden: Selbstverlag

Meiser & Mertig, ed. 1895. Physik: 400 Versuche aus dem Gebiete der Mechanik, Akustik, Wärme, Optik, Elekticität: Uebungsbuch für den Experimentirkasten von Meiser & Mertig. 4th ed. Dresden: Selbstverlag

Meiser & Mertig, ed. 1897a. 480 Uebungs-Aufgaben mit Auflösungen für die Sammlungen von Apparaten zum experimentellen Studium der Physik von Meiser & Mertig. 7th ed. Dresden: Selbstverlag

Meiser & Mertig, ed. 1897b. Meiser & Mertig's Sammlungen physikalischer Apparate. Dresden: Selbstverlag

Meiser & Mertig, ed. [approx. 1910]. Preisverzeichnis Nr. 27 über Physikalische Apparate und Chemische Geräte. Chemitz: Hugo Wilisch

Meyer, Wilhelm M. 1892. Illustrirter Leitfaden der Astronomie. Physik und Mikroskopie in Form eines Führers durch die Urania zu Berlin. Berlin: Paetel

Meyers Konversations-Lexikon: eine Encyklopädie des allgemeinen Wissens. 1885-1892, 19 Bde. 4th ed. Leipzig, Wien: Verlag des Bibliographischen Instituts

Pabst. A. 1910/1911. Manualismus? Neue Bahnen. Zeitschrift der Reichsfachschaft IV im NSLB Leipzig 22(4): 164-167

Poske, Friedrich. 1910. Über die Notwendigkeit der Errichtung einer Zentralanstalt für den naturwissenschaftlichen Unterricht. Leipzig, Berlin: Teubner

Rosenberg. Karl. 1919. Experimentierbuch für den Unterricht in der Naturlehre, 2 Bde. 4th ed. Wien, Leipzig

Schäffer, Carl. 1913. Biologisches Experimentierbuch: Anleitung zum selbsttätigen Studium der Lebenserscheinungen für jugendliche Naturfreunde; für mittlere und reife Schüler. Leipzig, Berlin: Teubner

Scheid, Karl. 1904. Chemisches Experimentierbuch für Knaben. Leipzig, Berlin: Teubner

Schröder, Conrad. 1903. Leitfaden der Experimentalphysik: Eine Anleitung zum Gebrauch der physikalischen Apparate für Volks-, Bürger- und Fortbildungsschulen. Leipzig: Schneider

Schulze, Richard. 1913. Elektron: 104 Schülerexperimente aus dem Gebiete der Elektrizität. 4th ed. Werdau: Booch

Spilger, Ludwig. 1914. Biologische Versuche: Als Anleitung zur Benutzung des "Biologischen Experimentierkastens". Stuttgart: Bopp

Secondary Literature

Bonnekoh, Werner. 1992. Naturwissenschaft als Unterrichtsfach. Stellenwert und Didaktik des naturwissenschaftlichen Unterrichts zwischen 1800 und 1900. Frankfurt am Main: Lang

Freyer, Michael, ed. 1995. Vom mittelalterlichen Medizin- zum modernen Biologieunterricht, 2 Bde. Passau: Wissenschaftsverlag Rothe

Gee, Brian. 1989. Amusement Chests and Portable Laboratories: Practical Alternatives to the Regular Laboratory. In: The Development of the Laboratory. Ed. by Frank A. J. L. James. London: Macmillan: 37-59

Hilz, Helmut and Georg Schwedt. 2002. Zur Belustigung und Belehrung: Experimentierbücher aus zwei Jahrhunderten. München: GNT-Verlag

Hilz, Helmut and Georg Schwedt. 2002. Naturwissenschaften kinderleicht. Ein Streifzug durch die Geschichte des Experimentierbuchs. Kultur & Technik 26(4): 28-31

Keckstein, Rainer. 1981. Die Geschichte des biologischen Schulunterrichts in Deutschland. Bad Salzdetfurth: Franzbecker Didaktischer Dienst

Keene, Melanie. 2007. 'Every Boy & Girl a Scientist' Instruments for Children in Interwar Britain. ISIS 98(2): 266-289

Öxler, Florian and Christoph Friedrich. 2008. Experimentierkästen "ohne den geringsten Nutzen"? Eine Diskussion Ende des 18. Jahrhunderts. Chemie in unserer Zeit 42(4): 282-289

Retter, Hein. 1979 Spielzeug. Handbuch zur Geschichte und Pädagogik der Spielmittel. Weinheim, Basel: Beltz

Schöler, Walter. 1970. Geschichte des naturwissenschaftlichen Unterrichts im 17. bis 19. Jahrhundert. Erziehungstheoretische Grundlegung und schulgeschichtliche Entwicklung. Berlin: de Gruyter

Schwedt, Georg. 1992. Kabinettstücke der Chemie. Vom chemischen "Probir-Cabinet" zum Experimentierbaukasten. Kultur & Technik. Zeitschrift des Deutschen Museums 16.2: 42-47

Sennett, Richard. 2008. HandWerk. Berlin: Berlin Verlag

Vaupel, Elisabeth. 2001: Liliput-Labors: Vom Reiselabor zum Lernmittel für Autodidakten. Kultur und Technik 25(2): 42–45