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The prevalence and relevance of Natural History assessments in the school curriculum, 1858–2000: a study of the Assessment Archives

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Abstract:

Natural History has been part of our curriculum since 1858. Not as a single, continuous subject but embedded in many different subjects and qualifications. As OCR prepares to launch a GCSE in Natural History, this article draws on the historical resources of OCR and its predecessor the University of Cambridge Local Examinations Syndicate to show the range of natural history type subjects available to students, focusing on those for 16-year-olds. Referencing primary sources available from the Assessment Archives spanning the period from 1858 to 2000, this study reveals some of the qualifications available, as well as the scope and popularity of these subjects and the challenges faced by all those involved.

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The prevalence and relevance of Natural History assessments in the school curriculum, 1858–2000: a study of the Assessment Archives

Gillian Cooke (Group Archivist)

Introduction

Concern about our natural environment is at an unprecedented level. It permeates through all levels of media as the effects of climate change and fluctuations of biodiversity manifest throughout the world. There is a thirst for knowledge to understand our environment better and the impact of humans on the natural world. But while the introduction of a new GCSE in Natural History by OCR chimes with our times, natural history itself is not a new qualification, as shown from an archive of over 160 years of qualification documentation from the University of Cambridge Local Examinations Syndicate (UCLES), a predecessor of OCR, which contains a rich resource of natural history type qualifications available to children at all levels and ages.

Natural History is variously defined, but commonly described as “a domain of inquiry involving organisms, including animals, fungi, and plants, in their natural environment, leaning more towards observational than experimental methods of study”. Fuelled by curiosity and, in some cases, imperialistic vanity, wealthy explorers of the early modern period sought to dispel images of fantastical creatures and flora from folklore with accurate scientific observation. So began a trend to collect and display natural history findings, and a rise in the popularity of natural history museums, which was at a peak in Britain between the 1880s and 1900s (Rader & Cain, 2015). However, as tastes changed and funding became scarcer, conflict grew between curators, scientists, and conservationists. The educational value of this type of objectification of the natural world, with its safe and organised view of nature, seemed at odds with escalating environmental issues, and the role of natural history education gradually shifted to meet demands for a broader understanding of the laws of nature.

The Cambridge Assessment archive provides a commentary on our social history. The examinations set for school leavers reflect contemporary educational expectations and give us an insight into the aspirations of society and the

achievements of students. This repository of primary sources includes question papers, examination regulations, statistics, examiners' reports, and syllabuses (or "schedules") all arranged chronologically. This article attempts to cover the period from the first examinations in 1858 to 2000, two years after the creation of OCR. I have focused on end-of-school examinations offered to 16-year-olds, but have included references to other levels and qualifications to provide context and continuity. The article aims to show the types of qualifications available to candidates and the range of documentation held in the archives. It also looks at the relative success of the subjects over time. UCLES was just one of several examination boards throughout this period. Initially a pioneer of school examinations, when few children attended school beyond primary years, UCLES was one of over 10 boards serving school leavers in England and Wales by the mid 20th century. These were reduced to just four in the 1990s when OCR was created within the UCLES Group specifically for examinations in England. It should be noted that all the information in this article only covers UCLES and OCR.

But what about the definition of natural history? Few subjects can trace a direct line from the 19th to the 21st centuries and natural history is no exception. It takes a circuitous route through several differently named subjects and overlaps with Biology, Geography, Hygiene and Drawing. There are also potential natural history type questions in examinations on Environmental, General, and even Domestic Science. It is difficult to find one common clear definition of natural history but, as the scientific study of animals and plants, there is one consistent emphasis that the study is *observational* rather than *experimental*, and this is the guiding definition used for this article.

This study will form three chronological groups: from 1858 to 1906, 1907 to 1942, and 1943 to 2000. The first and second periods are separated by a major revision in the natural history curriculum in 1906, but throughout both periods the certificate for the qualification was dependent on candidates passing examinations from a range of subjects grouped in different "sections" of broadly similar content, such as languages and sciences. No candidate, therefore, took a single subject qualification in natural history, and subjects such as Botany and Zoology do not consistently appear in one defined section, as is shown in this article. The main qualifications in the first period were the Juniors for under 16s and the Seniors for under 18s, which, after 1917, became the School Certificate and Higher School Certificate. A review of natural history assessment was carried out in 1943, the beginning of my third group of study, and the findings of this review fed into the new single subject national examinations of Ordinary (O) and Advanced (A) level qualifications first taken in 1951. During this period, end-of-school examinations became more widespread, and a national curriculum was first applied to secondary schooling in the 1990s. In 1987 the O level was replaced by the General Certificate of Secondary Education (GCSE) for UK examinations. For each period, I will look at trends and statistics, and natural history coverage in other subjects and at other levels. In the final part I will consider themes and comments from examiners, which may indicate threads common to the whole period from 1858 to 2000.

1858-1906

“The candidate is required to make a careful drawing from memory of a portion of the stem of the white lily, bearing a flower, flower-buds and leaves”

This apparent question for natural history candidates is, in fact, an hour-long question set for Senior candidates in Drawing in the first examinations of 1858.

These first examinations were pioneering, a manifestation of a Victorian ethos of self-improvement, and the first candidates were young male students, eager to acquire a recognisable standard of education before taking up professional work.

While Junior candidates could select Botany or Zoology, the equivalent subjects available to Seniors were called “Botany and Vegetable Physiology” and “Comparative Anatomy and Animal Physiology”. Long names for which questions were set on the description and classification of animals and plants.

“It is humbling”, wrote Linda Few, Biology Subject Officer, “to note that these exams were sat in the same year that Charles Darwin and Alfred Wallace independently proposed the theory of Evolution by Natural Selection” (1858 Question Paper Book, Cambridge University Press, 2008).

Indeed, the subject names and crossover of subjects gives a strong sense that these first examinations, which were independently run by the University, were experimental. There were several drawing examinations and Drawing and Design Drawing candidates alike faced tasks to draw a convolvulus plant, a branch of the woody nightshade, the flowering spike of a foxglove, a human figure in action or a thistle plant – all from memory.

By 1867, Comparative Anatomy had become Zoology, and Vegetable Physiology was renamed as Botany. Geology and Physical Geography was also added, expanding the section to three subjects. Three of the eight Botany questions in this year refer to the “natural order” while the questions in the Geography papers are chiefly concerned with locations and trade.

In 1879, Zoology, Botany and Geology formed a designated “Natural Sciences” section which, by 1895 included Chemistry, Heat, Statistics, Dynamics, Hydrostatics, Electricity and Magnetism, Physical Geography, Physiology and Hygiene. In the early years, Physiology and Hygiene examination questions asked candidates about heart function, breathing, and skin but also about purity of water. By then candidates were required to pass different subjects from up to eight different sections to make up their qualification.

In 1903, the Natural Sciences section was replaced by a section called Biology and Physical Geography. Botany and Zoology were moved to this section and new, additional, sections for Chemistry and Physics took the total number of sections to 16, with between one and six subjects per section. Therefore, as the options for candidates expanded, so did the possibilities for candidates to take sciences without choosing Botany or Zoology.

THURSDAY, 15 December 1898. 6 to 8.

Zoology

Only six questions may be attempted, of which the first must be one: special importance is attached to the careful answering of this question.

1. Name, describe, and draw the specimens A and B.
2. Describe carefully the external structure and the mouth apparatus of a snail. To what group does it belong?
3. Give an account of the structure and life-history of one example of the Protozoa.
4. Refer the following animals to their respective groups, giving your reasons in each case:
Rabbit, tortoise, star-fish, bat, crab, caddis-worm.
5. Write a short essay on *one* of the following subjects:
(a) An insect which you have reared yourself;
(b) A bird whose habits you have personally observed.
6. Explain the following terms:
Larva, migration, compound eye, carapace, seta, carnivorous, ruminant, hibernation, biped.
7. Give the principal characteristics of the Annelida, the Echinodermata, and the Reptilia, mentioning three examples of each group.
8. Give an account of any members of the group Crustacea which live upon land or in fresh water.

Figure 1: UCLES Junior Zoology Question Papers, December 1898

Trends

Despite the inclusion of so much natural history in the first examination of 1858, the statistics of 1867 (see Table 1) show a low take-up of Zoology and Botany. In that year just 3.3 per cent of the total Junior entry presented themselves for Zoology and 1.4 per cent for Botany. In the Seniors, take-up was even lower and represented just two candidates, both of whom were in West Buckland in Devon.

By 1877, school examinations had become more embedded into school life. The 1870 Education Act introduced compulsory elementary education for all, and end-of-school examinations – although still only applicable to a select few – began to reflect society’s educational expectations. Furthermore, the exams were, by then, also available to girls on the same terms as boys and this increased the take-up of Botany.

The 1877 timetable shows that Botany and Zoology were given an evening slot in the week-long mid December exam series. The issue of evening examinations and candidate “overstrain” was taken up in the *Journal of Education* in 1893, which cited the Botany practical as a potential third exam for candidates that day. Excess aside, an examination involving specimen identification from six until eight on a December evening with no electric light would have challenged both candidates and their presiding examiners. The examiners themselves noted that many Botany Juniors “appeared to have had scarcely any practical teaching”. As the timetable expanded and the exams session spilled over into a second week, Botany retained an evening slot.

Table 1: Home candidates for Botany and Zoology, 1867–1907 (December exams).

	Juniors						Seniors							
	Total candidates		Zoology/ Nat History		Botany		Total Candidates		Zoology/ Nat History		Botany			
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls		
1867	1196		40		17		273		8		2			
1877	3093	1308	No subject figures given						590	885	No subject figures given			
1887	4986	2519	52	72	69	420	644	1457	6	62	5	257		
1897	5378		25	17	33	719	852	1339	2	15	21	287		
1907	4400	2703	55	21	57	759	1966	2301	10	10	19	573		

Exams were only taken in December up to 1907 when Natural History of Animals replaced Zoology.

By 1887 the disparity of entries between boys and girls had become marked. Overall performance was first noted by examiners in 1878 when “the work of the girls was decidedly superior to that of the boys” but Botany, as a subject choice, was consistently more popular among girls, with 16.6 per cent choosing the subject in 1887 compared to just 1.3 per cent of boys. It is not clear why this was the case; there was a drawing element to Botany, and drawing was targeted at girls, but there is no discernible focus on medicinal properties of plants, which may have favoured a higher female candidature at that time.

Questions throughout this period are notoriously repetitive with the same themes, and even identical questions, appearing again and again in some subjects. However, this appears to be less common in Botany and particularly Zoology. Although the format of questions is repeated often, the subject matter varies considerably, which would have made these examinations challenging.

Other qualifications

In 1869, the Higher Examinations were introduced for over 18s, predominantly for women training to become teachers, and in 1895, Preliminary Examinations were introduced at the lower end for 14-year-olds. Both qualifications attracted more female than male candidates and included Botany papers. The Higher exams also added Zoology, and there were practical examinations in each. Candidates completing the Higher Examinations of Practical Zoology in June 1897 were asked to dissect a snail and sketch the dissection, while Preliminary candidates of Elementary Botany in December 1896 were asked to botanically describe the edible parts of the potato, strawberry, carrot, almond and plum.

In 1901 a whole new Seniors section was created for Agricultural Science, comprising two compulsory question papers on Agricultural Botany, Chemistry and the Principles of Agriculture. This section germinated into a whole new subject in 1906.

Botany. (Senior.)

[This Schedule is the same as that in force for the year 1906.]

Questions will be set in the subject as defined for Junior Students, with the addition of the following Natural Orders: Violaceae, Geraniaceae, Rubiaceae, Dipsacae, Campanulaceae, Ericaceae, Solanaceae, Euphorbiaceae, Corylaceae, Cyperaceae, Gramineae, and also the life-history of a typical Moss and Fern and of *Pinus*¹. For distinction Students will be expected to show also a practical acquaintance with the physiology, the life-history (including development), and the structure (morphology and minute anatomy) of the following organisms:—Saccharomyces (Yeast); *Pleurococcus*; *Mucor* (a Mould); *Spirogyra*; *Fucus* (Brown Seaweed); Fern; Flowering plant (Conifer, Monocotyledon, Dicotyledon). Students should bring a pocket lens and a dissecting needle.

Natural History of Animals. (Junior.)

1. The general structure of a Mammal.
The more important characteristics, as regards form and habits, of the following Mammals: Monkeys, Bats, Moles, Hedgehogs, Carnivores, Ungulates, Whales, Rodents, Marsupials.
2. The anatomical features peculiar to Birds, and their adaptation to flight.
The principal diversities in external form and habits characteristic of the main groups of Birds.
The eggs, nesting and singing habits, and migration of common British species.
3. The life-history and habits of a Frog.
4. The external features and mode of life of a Fish.
5. The external features and mode of life of a Snail, a Cockroach, and an Earthworm.
6. The life-history of a Moth or Butterfly.
The distribution and habits of the better known British species of Moths and Butterflies.

Students will not be expected to cover the whole Schedule, and the paper will contain more questions than the candidates are allowed to answer. Importance will be attached to evidence of personal observation on the part of the candidates.

A specimen paper of questions can be obtained on application to the General Secretary.

¹ For Senior Candidates at Colonial and Foreign Centres, the list of Natural Orders includes those for Juniors as given in the note on the preceding page, together with the following: Anonaceae, Nymphaeaceae, Tiliaceae, Melastomaceae, Apocynaceae, Solanaceae, Bignoniaceae, Amarantaceae, Urticaceae, Orchidaceae, Araceae, Cyperaceae, and also the life-history of a typical Moss and Fern and of *Cycas*.

Figure 2: UCLES Botany and Natural History of Animals Schedules, 1907

1907-1942

During the early 20th century, the science options available to candidates continued to expand. Along with Agricultural Science in 1906 (see Table 4), there was Hygiene, Physical Geography, Chemistry, Physics, Heat and Experimental Science and, in this year, Zoology was replaced by the Natural History of Animals. The new syllabuses coincided with the introduction of a summer examination session, which gradually became the standard examination session for “home” candidates (in England).

The new regulations for the Natural History of Animals attempted to address the size of the subject. It was stressed that students would “not be expected to cover the whole schedule” and were encouraged to use common English terms, rather than Latin, whose unfamiliarity would add to the candidate’s workload and was “apt to give a distaste for the subject”. Botany teachers were asked to “keep in mind the importance of naked-eye work and of experiments performed by the students themselves”; they were encouraged to arrange “excursions into the country ... to enable students to observe the plants of different classes of habitats”, as “special weight” would be given to candidates’ descriptions of specimens.

In 1917, the new Board of Education introduced a national system of school leaving examinations. The School Certificate replaced the Senior Local Exams, and the Higher School Certificate was introduced for under 18s. Despite this change, the schedules for Botany and the Natural History of Animals remained the same as those introduced in 1906 and these subjects were part of a four-subject section

with Physiology and Hygiene, and Physical Geography, for which candidates needed to pass just one subject to pass the section. By 1921 the School Certificate had been arranged into four groups, the third of which comprised science subjects. The accessibility of Botany and the Natural History of Animals was compromised by a requirement that candidates could only take these subjects at centres with properly equipped laboratories for which the centre may impose an extra fee on the candidate.

Botany examinations “for Colonial centres” appeared in 1898 and, from 1910, there were Botany and Natural History schedules for “centres in Tropical Countries” with references to arborescent plants and seasonal changes. The introduction of national exams allowed the traditional Cambridge Senior and Junior examinations to become more tailored to the needs of overseas candidates, and schedules were extended to include “oversea alternative” questions for Botany candidates, which in 1937 included questions on bamboo and jack-fruit trees.

In 1931, with entries in continual decline, Natural History was examined for the final time and this marked the end of a “Natural History” titled examination. By then the paper was still a Junior examination, which was predominantly taken by overseas candidates. Thereafter, Zoology existed only as a section within General Science Paper II, which also included sections on Botany, Soil Science, Domestic Science and Physiology and Hygiene, until that, too, disappeared in 1935.

Trends

While more girls than boys continued to choose Botany at both Junior and Senior levels, the entry levels for Zoology or Natural History of Animals (which replaced Zoology in 1907) remained comparatively low but consistent between the sexes (see Tables 2 and 3).

Table 2: UK and overseas candidates for Botany and Natural History of Animals between 1910 and 1918.

Year	Juniors			Seniors		
	Total	Botany	Natural History of Animals	Total	Botany	Natural History of Animals
1910	9030	1219	51	8182	1587	23
1912	9199	1107	35	8157	1610	22
1914	10 187	1483	19	9506	1791	53
1916	9009	1417	57	10 235	2495	45
1918	9177	1555	53	8869	2588	43

Table 3: Junior candidates for Botany and Natural History of Animals, 1910.

	July		December	
	Boys	Girls	Boys	Girls
Botany	35	651	70	463
Natural History of Animals	11	8	25	7

Table 4: Candidates for Agricultural Science (and Rural Science), 1907-1997.

Agricultural Science (Home candidates)				% passes at grade C and above	
Qualification	Year	Boys	Girls	Boys	Girls
Seniors	1907	46	0		unknown
Seniors	1917	9	0		unknown
Seniors	1927	37	2		unknown
None	1937				
None	1947				
O Level	1957	49	6	55.1	83.3
O Level	1967	148	10	47.3	80
O Level	1977	136	34	45.6	44.1
O Level	1987	109	28	61.5	46.4
GCSE Rural Science	1997	863	653	19.7	28.1

After a surge in candidate entries in 1914, possibly in reaction to the uncertainty of war, candidate numbers for all subjects dropped, rising again after the introduction of national qualifications which precipitated a shift of UK candidates towards June, rather than December exams. In the last examinations for the Natural History of Animals in December 1931 just one boy and three girls entered at School Certificate level from the UK.

The inclusion of sections on Botany and Zoology in a single General Science Paper in the 1930s makes it harder to identify candidates who chose these subjects as there is no evidence to show that General Science candidates would have answered any natural history questions at all, and although Botany was retained as a separate science subject, Table 5 shows the decline in its popularity.

Table 5: School Certificate candidates (UK) for Botany, Natural History and General Science, 1920-1945

	Total	Botany		Natural History of Animals		General Science		Total % of candidates
		Boys	Girls	Boys	Girls	Boys	Girls	
1920	7785	40	2521	36	22			33.6%
1925	9476	88	2240	39	25			25.2%
1930	9795	169	2353	33	6	135	84	28.3%
1935	9208	113	1536			260	338	24.4%
1940	9569	69	757			895	794	26.2%
1945	12 270	32	405			1600	1222	26.5%

Other qualifications

After the withdrawal of the Higher Examinations in 1923, two new qualifications were introduced for aspiring teachers, but at very different levels. The Rural Pupil Teachers qualification targeted pupils who had completed primary education and could support the education of their younger peers in rural areas. It ran from 1929

to 1936 and included a Natural Science question paper of compulsory sections on Zoology and Botany based on “recognition and familiarity with main crops, trees, flowers ... and the habitats of the common wild life of the countryside” (Rural Pupil Teacher Natural Science Regulations, 1929). A more formal higher grade teaching qualification was set up in collaboration with Homerton College in 1927 and the Homerton College Final Examinations ran until 1951. These included a paper on Gardening with questions on soil cultivation, the cultivation of plants, and insect and fungoid pests.

The 1930s also saw a revival in natural history themed drawing exams with a two-hour question paper entitled Nature Drawing which was placed in the Art Section of the School Certificate. This became Painting or Drawing from Plant Life in 1946. Geography Papers continued to include questions on climate, temperature, and rainfall. Agricultural Science, which was introduced during this period and aimed at boys, was in two parts: part 1 was concerned with the application of chemistry and physics to crop growing, and part 2 was concerned with the biology of farm crops and weeds.

Physiology and Hygiene (later, just Hygiene) was pitched at girls and became a more practical test of candidates’ knowledge of first aid and self-care, with questions on air quality and dental hygiene; skills that would have been highly valued before the establishment of the National Health Service.

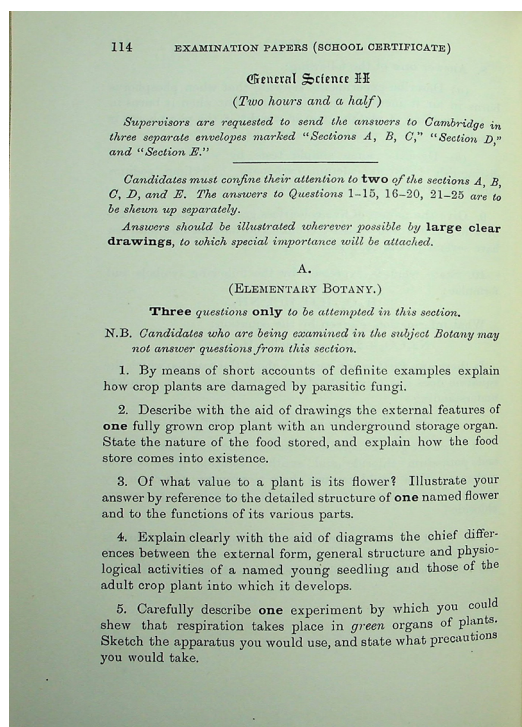


Figure 3: UCLES School Certificate General Science II Question Paper, June 1933

1943-2000

In 1943 a Joint Committee drafted a report containing recommendations for sixth form study covering Biology, Botany and Zoology to address concerns that the syllabuses in these subjects were outdated and “too much concerned

with questions which seemed important a generation ago". It included wide representation from three examination boards: Cambridge (UCLES), Oxford (UODLE) and Oxford and Cambridge (OCSEB), plus the university faculties of Biology and Medicine, College Scholarship Groups, and male and female science teaching associations.

The committee took up a concern raised by examiners in 1925 that the size and scope of natural history could prevent detailed study and "impede the development of free observational skills". It therefore advised that "the student should be encouraged to make a really thorough study of a restricted part" of the syllabus to "train his scientific judgement in the best possible way". The recommendations led to new syllabuses for the Higher School Certificate which remained largely unchanged over the following decade.

During the Second World War subject options reduced and topics within the subjects became more generic. In 1947 a revision of the Science syllabus attempted to address their "increasing popularity" but this did not affect the Botany School Certificate papers. These remained unchanged and separate from the seven General Science question papers and included Biology and Geology but not Zoology.

With the introduction of the first single subject qualifications in 1951, candidates could specialise in specific subjects without having to select a subject group to make up their certificate qualification. In the first year Botany was available to Ordinary (O) level candidates for 16-year-olds but from 1952 the lowest qualification for both Botany and Zoology was the Alternative Ordinary level (AO), which was aimed at sixth formers. These qualifications were available to UK and overseas candidates, but, as earlier, they were restricted to candidates at schools with suitable equipment for practical work.

Agricultural Science survived to become an O level subject, and in 1970 Environmental Science replaced O level General Science within the Combined Sciences section. According to the new syllabus, its principal idea was "the relationship of Man to his environment". It was revised in 1986 when it was offered to UK candidates only, and the course was then described as a natural science course based on "experimentation, observation and logical deduction".

In 1987 the General Certificate of Secondary Education (GCSE) was introduced for UK candidates as a replacement for O level, aimed at a wider cohort. Agricultural Science, however, remained as an O level qualification (presumably to meet an overseas candidature) and, in 1989 Rural Science was introduced at UK GCSE level. Described as "an applied science" with expectation that "full use will be made of the plants, animals and materials found locally", this qualification ran to the millennium.

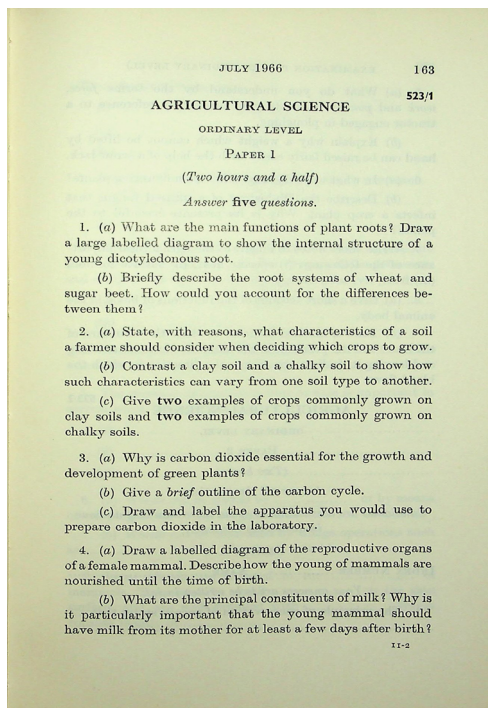


Figure 4: UCLES O Level Agricultural Science Question Paper, June 1966

Trends

More data is available for this later period, and although it is potentially confusing to juxtapose different subjects at different levels, Tables 6 and 7 do indicate trends that Zoology, Botany and later Environmental Science trail behind other subjects in both entries and results.

Table 6: Sixth form AO level candidates for Botany, Zoology and Geology, 1955-1970.

	Total candidates	Botany			Zoology		
		No. of candidates	No. of passes	% passes	No. of candidates	No. of passes	% passes
1955	4976	38	26	68.4	9	8	88.9
1960	8590*	62	43	69.4	0		
					Geology		
1965	13 883	60	29	48.3	522	341	65.3
1970	16 120	56	37	66.1	911	552	60.6

*From 1960 candidates counted twice if entered for A and O level.

Table 7: GCE candidates for natural history type examinations (UK summer, 1975–1985).

	O levels				AO levels			
	Environmental Science		Agricultural Science		Botany		Geology	
	No. of candidates	% passes	No. of candidates	% passes	No. of candidates	No. of passes	No. of candidates	% passes
1975	665	41.7	165	46.7	6	2	118	62.4
1980	226	41.2	155	40.6	-	-	722	57.9
1985	18	22.2	130	58.5	-	-	416	61.5

Although this period sees the loss of Botany and Zoology altogether from UCLES school leaving examinations, the subjects continued to be available to sixth formers for a little longer. The suggestion in the 1943 Joint Committee report was that the subjects were too complex and broad for assessment at 16, and the requirement for specialist equipment and resources placed the subjects out of reach of many students. By combining aspects of Botany and Zoology into Rural Science (Tables 8 and 9), however, the potential remit of this new qualification became even bigger, as a remark by the 1991 examiners indicates: “It was noticeable that many candidates displayed a good knowledge of either plants or animals but not both.”

Table 8: Candidates for Rural Science, 1990-2000.

	No. of entries	% of OCR GCSE syllabus entries	% of passes at grade C and above
June 1990	1680	0.10	23.6
June 1995	1602	0.11	28.5
June 2000	1028	0.08	23.95

Other qualifications

As well as being available to sixth formers, Botany and Zoology were also retained as A level subjects, and the entries for A level give an indication of the respective popularity of Biology, Botany and Zoology.

Table 9: A level entries for Biology, Botany and Zoology 1970-1990.

	Total no. of entries		No. of entries for Biology		No. of entries for Botany		No. of entries for Zoology	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
1970*	6613	5519	1123	1409	121	111	285	237
1980	13 903	13 844	1855	2362	9	15	59	72
1990**	38 712		3717		18		54	

*The 1970 annual report notes that A Level Home Centre entries for Biology rose by 9 per cent on the previous year.

**The published examination statistics for UCLES for 1990 do not give a breakdown of candidates by sex.

ENVIRONMENTAL SCIENCE
5015

GCE ORDINARY LEVEL

This subject is available to U.K. centres only. It may not be taken with 5050, 5070, 5090, 5124-9. It is not available in the November examination.

Introduction

The subject, although subdivided in the syllabus sections, should be treated in an integrated manner and no attempt made either to eliminate appropriate areas of traditional science or to separate these from the subject matter. The course is essentially inter-disciplinary and intended to offer a course in the natural sciences to those students who may not be studying other science subjects. It may, however, also provide a complementary course for students wishing to relate their study of another science to their environment.

The lack of formal division into traditional subject areas is not intended to indicate that the course should neglect the training of students in scientific method. Experiment, observation and logical deduction are important areas of intellectual development that should be integrated into the teaching programme wherever practical. There are suggestions for some appropriate experimental work within the content of the syllabus.

The syllabus is divided into two sections, a (common) core and a selection of special topics which develop the ideas of the core syllabus and are intended to allow the introduction of local resources into the teaching of the syllabus.

The presentation of the syllabus section does not imply a particular order of teaching and it is considered desirable that candidates should be able to relate topics from various sections of the syllabus and to acquire an integrated view of the study of environmental science.

Aims

The syllabus aims are:

1. to provide the opportunity for pupils through practical studies in science to obtain sufficient understanding and knowledge
 - 1.1 to become well-informed and hence confident citizens in a technological world;
 - 1.2 to realise the usefulness, and limitations, of scientific method and its applications in other disciplines and in everyday life;
 - 1.3 to be suitably prepared should they intend to continue beyond the 16+ level with more specialised studies in pure sciences, in applied sciences, in science-dependent vocational courses;
 - 1.4 to have a suitable course should they cease to study science at this level;
2. to develop abilities and skills that
 - 2.1 are appropriate to the study and practice of science;
 - 2.2 are useful for everyday life and encourage safe practice;
3. to stimulate
 - 3.1 curiosity about science, enquiry into science, interest in science, enjoyment of science;
 - 3.2 respect for the environment;
4. to promote an awareness that
 - 4.1 the study and practice of science are cooperative and cumulative activities and are subject to social, economic, technological, ethical and cultural influences and limitations;
 - 4.2 the applications of science in everyday life may be both beneficial and detrimental in the contexts of the individual, the community and the environment.

Figure 5: UCLES O Level Environmental Science 5015 Syllabus, 1986

Common themes and concerns

“The answers in July shewed intelligence and good teaching; those in December shewed neither.”

The period under consideration is nearly 150 years, during which time there were two major revisions of the natural history curriculum and numerous manifestations of natural history type qualifications. It is, however, possible to trace threads of continuity throughout the entire period.

The examiners’ reports are a rich resource of comments, both informative and amusing. They are mostly critical and unashamedly opinionated, as demonstrated by the examiners of 1910 above, but they are a source of continuity in a complex puzzle of perennial change.

Quality of teaching

Criticism on the quality of teaching is common to all subjects and the following, though found in natural history sections, could be applied elsewhere. These include references to the use of “obsolete textbooks”, inappropriate use of “technical terms”, the need “to give pupils some questions of a problem type during the year”, and “considerable evidence of poor reading of the questions”.

The following, from the examiners of 1887, is more relevant to Botany teaching, and references a recurring theme related to practical work and observation:

“It seems clear that if this subject is to be successfully taught in schools the teachers must keep their own knowledge fresh, and endeavour to teach the subject in such a way that it shall be an actual training for the eye and brain and not mere effort of memory.”

Practical tests

Botany and Zoology examinations included practical tests which attracted many comments on student training and experience. Comments such as that in 1897 that “there still appear to be a few schools where students have no practical instruction” led to clear direction to include practical teaching in the revised regulations of 1906, but examiners in 1908 noted dubious levels of compliance at Junior Botany exams:

“The many inaccuracies in the description of experiments produced an impression that the apparatus had been arranged by the teacher, and that the students had had no opportunity of performing the experiments themselves.”

By 1914 examiners had become frustrated and offered a stark warning to teachers that “unless the teaching of natural history can be assisted by fieldwork and other means of encouraging observation the result is not worth the time devoted to the subject”.

The A level Botany report of 1958 repeats the theme, noting “too much preoccupation with the textbook ... with too little appreciation of the living plant as observed by naked-eye and lens”, and examiners in 1982 commented that “it would appear that field ecology and experimentation receives little attention in schools”.

The GCSE Rural Science examiners of 2000 decided on a more proactive approach and stated a clear incentive to incorporate practical work into teaching: “Those with practical understanding of the topic, who planned their answer, or ensured their answers were based on their knowledge of Rural Science, gained most marks.”

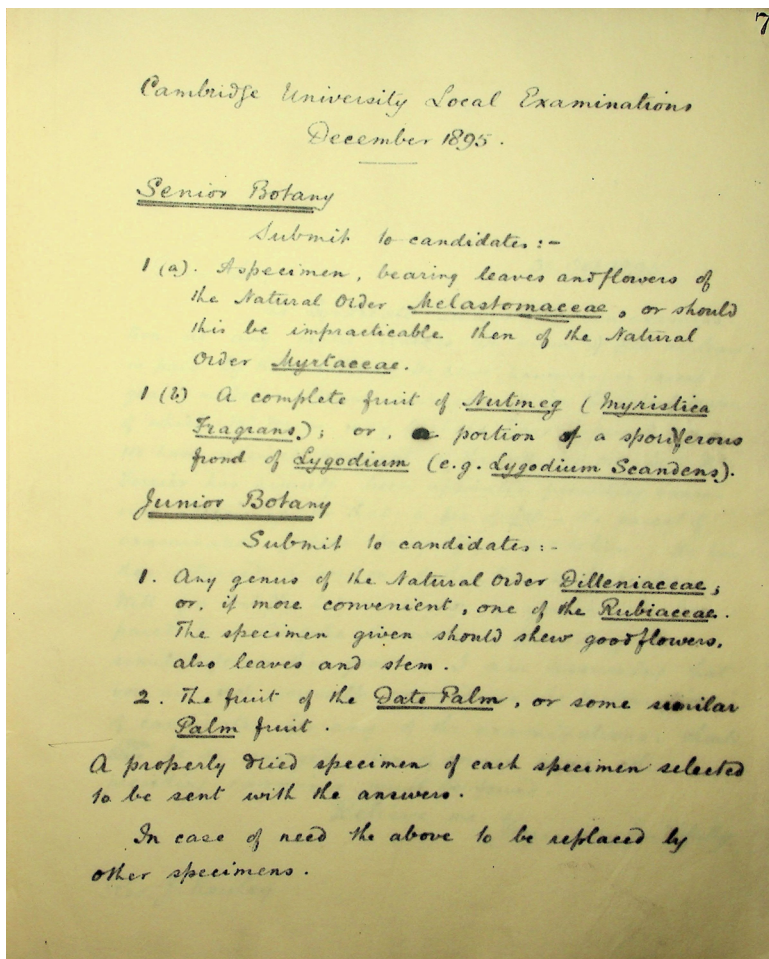


Figure 6: Botany samples recorded in UCLES Letter Book, December 1895 (Ref: UCLES/A/LB/1/7)

Observation

“He [the student] should cultivate the habit of observing for himself.”

Observation was an important part of the curriculum and was highly encouraged by examiners, as shown in this simple expression in the 1858 report, above. From 1906 to 1925, the Natural History and Botany schedules carry an annual reminder, written in italics, that “importance will be attached to the evidence of observation on the part of the candidate”. This message is not only published annually, but published twice, as part of both the Junior and Senior regulations each year.

Throughout this period there are examiner encouragements: “excellent answers were given ... especially where the candidate described direct observations made in the country” (1910), and disappointments: “The answers this year again suggested only too often the lack of actual observation” (1912).

In 1919 the Botany examiners noted “a noticeable lack of ability to make original observations and to attend to details” and, in 1925, the Natural History examiners commented that “too small a part of the knowledge shewn had been gained by first-hand observation”.

Some comments reference specific observational failings, as in 1907: “Hardly a candidate could determine either the age of a twig of Beech or the structure of its winter buds” and some, as this in 1912, record commendable effort: “Improvements especially in answers on birds ... Knowledge of common British insects was weak. Several good essays on the horse were sent up.”

Candidate observational skills were still being criticised by examiners at the end of the century, and examiners of Rural Science GCSE in 1996 concluded that “questions which relied upon candidates’ practical knowledge and observation were badly answered”.

Complaints on observational skills are not confined to the candidates, and the following comment from the O level Agricultural Science examiners of 1984 is a direct indictment of the teachers:

“The examiners were amazed, then baffled, and finally rather disconsolate that some teachers were not able to recognise and classify specimens that pupils were expected to identify.”

Drawing and diagrams

In the early years there was strong emphasis on drawing skills, which were essential before photography was commonplace. This is evident by the variety and prevalence of drawing examinations and drawing questions in Botany, Zoology, Natural History and Geography papers. Poor sketches and lack of precision are referenced in several examiners’ reports up to the 1930s, and the School Certificate Botany papers annually instruct candidates to answer with illustrations by large and clear diagrams or drawings.

An A level Zoology report on candidates’ work from 1954 to 1957 devotes a whole section to drawing, stressing the importance of drawing in demonstrating understanding of locomotion: “Candidates should be assured that the rapidly executed simple line drawing is as much a part of writing down zoological observation as is continuous prose.”

Throughout most of the period, drawing requirements changed little. An unconscious echo of the Drawing examination of 1858 finds O level Botany candidates in 1952 being asked to describe, with drawings, the climbing methods of a convolvulus plant.

There is, though, a notable shift in the significance of illustration towards the end of the period as the onus on candidates shifts from making to interpreting drawings in the question paper. The examiners of GCSE Rural Science in 1995 felt it necessary to note that: “It was obvious that many candidates responded without due reference to the diagrams.”

Environmental issues

“On what causes does the climate of a country principally depend?”

Questions on environmental issues can be found throughout the entire period but most, like the question above (from an 1858 Junior paper), are from Geography papers. Geography questions, however, can also overlap with Botany, and a Geography question on peat mosses in 1887 has similarities with a Botany question on the impact of soil and climate on vegetable growing in 1913. Reference to the interdependence of plants and animals features in a Botany examination as early as 1887, and there is repeated reference in both schedules and examination papers to “the natural order”.

The 1970 O level Environmental Science syllabus includes, as a subsidiary idea, “the use made by Man of natural resources both of energy and of materials”. On the final, 18th page of the syllabus, in a sub, sub, sub section, reference is made to chemical depletion of soil reserves, land use education, wise use of insecticides, the conservation of animal and plant life, and “world health”.

The same syllabus in 1975 introduces an optional topic on plastics: raw materials, production and uses, and, in 1986, a further revision includes “respect for the environment” as one of the aims of a course which covers exploitation of resources, conservation and pollution. An optional section offers candidates an ecosystem study involving a pond, wood, or coastal habitat. This syllabus may have pre-empted changing views in society as the examiners’ report is not positive and notes a “narrow treatment of conservation and land management” in the candidate answers.

Three years later, however, the examiners record “a noticeable improvement” and a possible cause: “In areas which have been popularised in the media, such as the greenhouse effect, and oil pollution, the quality of answers was particularly good.” As environmental issues grew in the collective consciousness, candidate answers continued to impress the examiners who, in 1996, commented that Rural Science GCSE “questions on the environment and conservation were well answered”.

Conclusion

This study is limited only by time and interest; the resources are plentiful and there is scope for more detailed study of all the resources, particularly the question paper holdings. Natural history assessments from the Cambridge examination board took several forms in this 150-year period and there are some common themes and trends that could be explored further. Some enduring themes are nicely summarised by the Botany examiner of 1866, just eight years after the examinations were set up:

“The careful examination (of the flowers and seed-vessels) of common plants seems to be overlooked, though it is indispensable to the acquisition of any real knowledge of the subject. The search for plants in the fields is a healthy exercise and induces a love of nature: it ought to make the study a popular one.”

It does seem clear that natural history assessments were initially a mainstream part of the curriculum but that, over time, they became displaced by science subjects and defined more as subsidiary than main subjects. The data in the tables shows that these subjects were not hugely popular with students and the pass rates were not high. The resources used here reveal entrenched, long-term difficulties in encouraging practical skills and observational exercises, perhaps due to the size and nature of the subjects, which did not lend themselves well to traditional classroom teaching methods of the 19th and 20th centuries. The frequent renaming and repositioning of natural history type subjects indicate that the calibre of the candidates and the fitness for purpose of the qualifications were a constant cause for concern. However, the resilience of both to repeatedly revisit the subject, to absorb new subject areas and to manifest themselves in new ways indicate a strength of purpose that may yet be fulfilled in the new qualification of the 21st century.

Dedicated to Michael Paduano.

Bibliography

Secondary source references

1858 Question Paper Book, Cambridge University Press, 2008.

Charwat, E. (2006). *The nature of Replications: Recontextualising Natural History Models and Casts from 19th to early 20th centuries in Britain and beyond.*

Rader, K., & Cain, V. (2015). *From natural history to science: display and the transformation of American museums of science and nature.* *Museum and Society*, 6(2), 152-171.

Spary, E. C. (2018). "Natural History". *Europe, 1450 to 1789: Encyclopedia of the Early Modern World.*

Primary source references (Cambridge Assessment Archives)

Homerton College Further Education, Examination Regulations 1930, UCLES/JC/HCFE

Journal of Education news cuttings, UCLES/ PP/JNK 2

OCR Examination Statistics, 2000

OCR GCSE Question Papers, Regulations & Reports, Asset Bank Past Papers Resource, 1991–2000

Rural Pupil Teacher Examination Regulations, UCLES/A/RPT

UCLES 1st to 68th Annual Reports, 1858–1925, UCLES/EX/AR

UCLES Examination Regulations and Question Papers, 1858, 1867, 1877 and 1879 (Copies from Cambridge University Library holdings Ref: Cam.c.II.51)

UCLES Examination Regulations, Syllabuses, Question Papers and Reports, Bound Volumes, 1884–1986

UCLES Examination Statistics booklets, 1970–1998

UCLES Higher Examination Question Papers, Bound Volumes of Higher Examinations, 1895–1905

UCLES Letter Book, October 1895–August 1896, UCLES/A/LB/1/7

UCLES Question Papers, Reading Room Booklets, 1937, 1950s–1980s