

**University of Cambridge
Local Examinations Syndicate**

**The Development of the Assessment of
Thinking Skills**

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June 2005

University of Cambridge Local Examinations Syndicate

The Development of Thinking Skills Assessment

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Foreword

A draft of this report was prepared by Joyce Chapman in September 2002 in order to capture the development work on Thinking Skills that had been undertaken by the University of Cambridge Local Examinations Syndicate since the mid-1980s.

Since that time there has again been an expansion of work in the area of Thinking Skills and this document provides an informative, general background to the current activity.

UCLES has a substantial history of work developing assessment of Thinking Skills and many institutions and individuals have been involved in helping the gradual emergence of the assessments seen today. Reference is made to project documents that were produced in those early days but unfortunately not all are still available now (see note about the availability of references on page iv).

The draft report has been tidied and a new final section has been added to outline the recent resurgence of interest in Thinking Skills. In doing so, the content has been changed as little as possible from the original draft.

Alan Willmott
June 2005

Note on References in this Report

In preparing this report, a wide variety of documents has been drawn on including many old project documents, many of which are no longer available. The references in the text are provided as usual and each one falls into one of four categories. The list of references in the References indicates into which one of the following categories each reference falls.

Category A

Reference to an existing publication or document that may be obtained in the usual way (e.g. from libraries, bookshops, etc.).

Category B

Reference to a document held in electronic form, in either Adobe pdf or MSWord format, which may be downloaded from the UCLES website under the Assessment Directorate's section listing publications, conference papers and other articles.

<http://www.ucles.org.uk/???????>

Category C

Reference to a document held in electronic form, in either Adobe pdf or MSWord format, and which may be downloaded from the UCLES website under the Assessment Directorate's section listing older (archive) documents of interest.

[http:// www.ucles.org.uk/???????](http://www.ucles.org.uk/???????)

Category D

Reference to an old UCLES project document that is no longer available.

University of Cambridge Local Examinations Syndicate

The Development of Thinking Skills Assessment

1 Introduction

This 'history' of the development of the assessment of Thinking Skills in the University of Cambridge Local Examinations Syndicate is mainly concerned with the MENO project. The background to the development is included, and there is a section on the Law Studies Test which preceded MENO and for some time existed alongside it. A list of MENO publications is included and references to these documents which include further details of many aspects of MENO will be made as appropriate. The references include discussion papers as well as other papers not directly referred to in the text.

During the lifetime of the project the value of Thinking Skills became seen as increasingly important. The Dearing Review of qualifications for 16-19 year olds highlights "*common concerns in universities that there is a need for students to be more rigorous in their thinking and approach to knowledge*" (12.80) and students should be encouraged and enabled to "*develop structured and logical thinking based on critical examination of evidence and expressed in rational arguments*" (12.77). The Vice Chancellor of the University of North London, Brian Roper said "*Higher Education requires students to have the ability to reason abstractly, the ability to reason logically, to draw inferences in a valid way and the ability to assess evidence*".

The assessment of Thinking Skills project had a variety of names throughout its history, as did the various components. Details of these are provided in Appendices 1 and 7. It should be noted that throughout this document the names used will be the names of the project and the components at that time.

2 Background

The University of Cambridge Local Examinations Syndicate (UCLES) is one of the world's leading assessment agencies, providing mainly school-based examinations. It has a long history of providing examinations for admission to Higher Education - A Levels.

By the mid 1980s the numbers of people wishing to undertake Higher Education were growing rapidly. Many of these people did not possess traditional entry qualifications. At the same time there was a view that A Levels were not always the best predictors of ability to succeed in Higher Education. The Syndicate then embarked on a research and development programme focused on the provision of tests of academic aptitude.

Between 1965 and 1976 various studies on aptitude testing were undertaken in the UK (see UCLES 1992a, 1993a) and in 1987 UCLES administered the first of an annual series of Law Studies Tests intended to measure the aptitude of prospective law students and of sixth formers who wished to know if they possessed the kinds of abilities demanded by law schools. This work was carried out in collaboration with the Law School Admission Services of the United States. The predictive validity of the Law Studies test (see Rule, 1989) proved to be disappointing.

At the same time UCLES was considering the idea of a general test of academic aptitude which would be useful for students entering other fields of study. Alec Fisher of the University of East Anglia was commissioned by UCLES to carry out development work on this idea. His reports proposed a general test of academic aptitude, provisionally called The Higher Studies Test (Fisher 1990a 1990b).

By early 1990 it was becoming clear that the aim should not be to produce a psychometric aptitude test. The aims should be the identification and definition of those Thinking Skills that are crucial to success in Higher Education and to the production of tests which would assess those skills directly. The purpose of the assessment was not only selection: guidance of students and diagnosis of weaknesses were as at least important.

At this stage the project was known as the 'Higher Studies Test' project. Within UCLES consideration was given to other names including the Higher Education

Aptitude Profile (HEAP), and the Academic Aptitude Profile (AAP).

3 Law Studies Test

In early 1986 discussions on the use of a UK version of the American Law School Admissions Test (LSAT) were held between representatives of UCLES and the University of Cambridge Law Faculty together with the President and Vice President of USA Law School Admissions Services. The meeting considered such issues as the degree of success of minority groups on the US test, the gradual acceptance of the LSAT, the extent to which coaching could improve scores, the relationship between LSAT scores and 'success' in legal practice, the fact that some questions could be answered in different ways, the requirements for applicants to Law School to disclose their results, the significance of age differences between the UK and US candidates, the time pressure of the test, the nature of multiple-choice questions (considered then to be alien in the UK), the possibilities of some schools coaching candidates, the way the UK results would be issued, the timing of results and the fees that might be involved.

After further discussions with various bodies, including the Committee of Vice Chancellors and Principals (CVCP) and UCCA, a UK version of the Law Studies Test Handbook was produced. This contained information on the purpose of the test, preparation for the examination, and administration details together with some sample questions, explanations of the answers, and guidance as to how to approach the questions. Another booklet, The Law Studies Test 1986, was also produced containing a complete sample paper.

The Law Studies Test was piloted in the summer of 1986 and the first live administration took place in June 1987. The test continued to be administered on an annual basis for some years and contained questions in three sections, Analytical Reasoning, Logical Reasoning and Reading Comprehension. Candidates generally took the test at the end of their first year in the sixth form and this enabled them to put these results on their UCCA, (later UCAS) applications.

Some Law Schools, including Cambridge, demanded that candidates took the Law Studies Test and have the results available when they applied for admission in the autumn before they would enter university if successful in their application.

4 1990 - 1991

During early 1990 consultations between UCLES and institutions of Higher Education (HE) took place. These institutions included Universities, Polytechnics and Colleges of Higher Education. The aim was to identify those skills that were felt to be necessary for success in Higher Education and it became clear that the main focus of further development should be the identification and definition of skills concentrating on two areas of Critical Thinking and Mathematical Reasoning. Eight of these institutions agreed to work with UCLES and four Steering Groups were set up, one for each of the three 'Thinking Skills' which had been identified during the consultation process, and one to consider the issue of 'fairness' or 'bias'. The Thinking Skills which had been identified were Logical Reasoning, Communicative Skills and Mathematical Reasoning. The Bias/Fairness Steering Group was to consider how the project could be developed so that particular groups (defined by gender, race, ethnic origin, age and social class) would not be

disadvantaged by the nature and administration of the assessment that was developed. The membership of these Steering Groups that worked from 1990-1992 is given in Appendix 2.

The initial meetings of the Steering Groups were held in the autumn of 1990 and one of the first tasks was to identify what should be assessed and suggest what might constitute suitable methods for the assessment. They also considered some of the issues which had been raised when the LST was developed, age difference, time pressure, the use of multiple-choice questions. All of the Steering Groups considered the language level that would be appropriate for the questions and initially it was thought that some applicants would find the language of the exemplar items difficult. However, all of the Steering Groups agreed that Higher Education required students to have a reasonably sophisticated use of language. It was thus agreed that the language level of broad-sheet newspapers was appropriate.

The Steering Groups agreed that Logical Reasoning, later called Informal Reasoning, was about the analysis of the kind of arguments that students would meet in the course of Higher Education and that Mathematical Reasoning, later called Formal Reasoning, was about logic and would make use of a variety of symbol systems. They also agreed that they should be assessed by five-option multiple-choice questions.

The Logical Reasoning component aimed to assess the kinds of reasoning skills used in the analysis and criticism of everyday arguments. The question categories were as follows:

- Summarising the main conclusion of an argument;
- Drawing a conclusion when premises are given;
- Identifying assumptions;
- Assessing the impact of additional evidence;
- Detecting reasoning errors;
- Matching one argument with a second which has the same logical structure;
- Applying principles.

These categories were the same as those used for the Logical Reasoning items in the Law Studies Test.

The assessment of Mathematical Reasoning concentrated on reasoning in terms of number, space and data representations. It aimed to assess “productive” or “search-driven” thinking. The underlying belief was that productive thinking is more indicative of transferable and general abilities than reproductive (rule-dominated) thinking. The theoretical model adopted for the construction of this assessment was Sternberg’s triarchic theory of intelligence (Sternberg, 1988) which suggests that intelligence is a combination of practical, creative and academic analytical intelligence; an illustration of this appears in UCLES (1992a). This approach identified three knowledge acquisition components:

- | | |
|-----------------------|---|
| Selective Encoding | (sifting relevant from irrelevant information); |
| Selective Combination | (combining certain pieces of information in a relevant way); |
| Selective Comparison | (comparing new information with information previously acquired). |

In addition to these three categories, questions would be classified as Spatial;

Linguistic/Data Handling; or Numerical.

The Steering Group also provided an outline of the knowledge which the Mathematical Reasoning items assume (UCLES, 1992a, 1992b).

For 'Communicative Skills' candidates were presented with two or three passages on related subjects. They were then required to answer a few short questions on the text and to write an essay related to the texts. The questions were intended to help candidates plan and prepare for the writing task by picking out significant points in the passage and were not marked right or wrong. Candidates were advised to spend thirty minutes reading the texts and answering the questions and the remaining thirty minutes writing the essay.

Item writing and item editing began in late 1990 and continued in 1991. Guidelines for item writing and editing were provided for Logical Reasoning and Mathematical Reasoning questions based on those which had been provided for the Law Studies Test item writers. During the early spring of 1991 pretests were constructed. For Logical and Mathematical Reasoning sub-tests of 8 questions were constructed and each sub-test was put into two pre-tests. Each pre-test contained two Logical Reasoning and two Mathematical Reasoning subtests.

Pre-testing was carried out during the spring and early summer of 1991 with students who were first or second year students at the participating institutions. As there were fewer than expected students who took part in the pre-testing, a small number of schools with sixth forms were approached and some pre-testing took place late in the spring term with second-year sixth formers.

During the summer, when pre-testing had been completed, analysis of the multiple-choice questions took place. Two kinds of analysis were applied, classical (or traditional) analysis and Rasch analysis. The classical analysis provided facility and discrimination values at option level, and the Rasch analysis provided other important data including the difficulty of questions and a measure of how well each question fitted with other questions in the pre-tests. This information was also the foundation of an item bank

In the spring of 1991 discussions were held with those institutions which had representatives on the Steering Groups and which had also agreed to take part in pre-testing and piloting (University of East Anglia, University of Essex, University of Southampton, University of Kent, Polytechnic of North London, Polytechnic of East London, Nottingham Polytechnic, and Luton College of Higher Education). These discussions involved members of the Steering Groups, Academic Registrars and/or Admissions staff as well as Access staff and covered the trials of questions, the content of the components and the usefulness of the Academic Aptitude Profile as a diagnostic tool. It quickly became evident that, as had been expected, there was a substantial divergence of opinion within and between the institutions, particularly about the use of the profile for diagnosis and guidance of students.

In the summer of 1991, ready for the beginning of the coming academic year, material for a small scale pilot was prepared. Sample papers and pilot papers for Logical Reasoning, Mathematical Reasoning and Communicative Skills were compiled. Each of the trial papers would take one hour. The Logical and Mathematical Reasoning papers contained 30 multiple-choice questions.

During this time discussions were taking place within UCLES and with the partner

institutions as to the format of the assessment. There would be an Academic Aptitude Profile (AAP) where test material would be provided for the institutions to administer themselves as and when required. There would also be a test, the Higher Education Aptitude Test (HEAT), set on a fixed date, or on an agreed number of dates, for which the marking would be undertaken by UCLES. The purpose of the AAP would be guidance and that of HEAT would be selection. A consultation document provided detailed test specifications (UCLES, undated). This document included specimen material but was not intended to be widely circulated.

Within UCLES, the Academic Aptitude Profile (as the project was then called), Steering Group continued to meet on a regular basis. Consideration at these meetings was given to issues such as the validity of the profile and test, content specifications and psychometric specifications. In addition reports from meetings with partner institutions and other interested groups were received.

At the same time discussions had begun on the use of a computer-adaptive test. The plan was to use this test for the Logical Reasoning and Mathematical Reasoning components.

5 Autumn 1991 - Autumn 1992

Discussions with the existing partner institutions continued and new institutions, Queen Mary and Westfield College and Anglia College of Higher Education, became involved – Colleges of Higher Education and Polytechnics became Universities in 1992. The Steering Groups continued to meet and within UCLES further work on the programming of the computer adaptive version of the tests took place.

During the year, the Communicative Skills component was reviewed and work began on revising the component. It became known as 'Critical Writing' and candidates were presented with a passage of 2 - 2½ sides of A4 paper. After reading the text candidates were required to evaluate the authors' arguments and produce further arguments of their own in the form of an essay.

Consultations and discussions during this time, particularly with Access staff, led to the development of a 'Task Directed Writing' component which was designed to lie between the basic and higher order skills. Candidates were presented with several texts or pieces of information. They were required to read the texts and use them to prepare a short piece of writing suitable for a given audience and for a particular purpose.

These discussions, also led to the development of three further components. These more basic skills would lead on to the higher order Thinking Skills. Consultations began on 'Numeracy' which would lead on to 'Formal Reasoning', and 'Understanding Argument' which would lead on to 'Informal Reasoning'. A 'Literacy' component was also developed.

Item writing continued for Formal and Informal Reasoning and Communicative Skills and further pre-tests were prepared for use during the second half of the 1992 spring term with A-level students. The construction of the pre-tests was the same as that for 1991, except the sub-tests now contained five questions each not eight as has been the case in 1991.

In the summer of 1992 a small scale pre-test of Understanding Argument, Literacy and Numeracy took place. Questions from the Informal Reasoning component were used as anchor items for Understanding Argument and Mathematical Reasoning items for Numeracy.

Preparations were also made for a small-scale pilot at the beginning of the coming academic year. Sample and pilot papers for Numeracy, Literacy, Understanding Argument, Task-Directed Writing, Critical Writing, Formal Reasoning and Informal Reasoning were constructed and a number of booklets for educational institutions were prepared (UCLES, 1992a; 1992b; 1993c).

Further information on the project at this time can be found in UCLES (1992a). Information about the planned future direction of the project can be found in Fisher (1992).

In the summer of 1992, ready for the beginning of the coming academic year, materials, including sample papers and pilot papers, for a small-scale pilot of Numeracy, Task-Directed Writing, Critical Writing, Formal Reasoning and Informal Reasoning were prepared.

6 Autumn 1992 - Autumn 1993

A pilot scheme was conducted in six HE institutions and in five FE institutions. One of the institutions, Queen Mary and Westfield College piloted all three higher-order skills with first-year undergraduates.

Research and development work on the components continued and a series of booklets was prepared for a large scale pilot in the academic year - 1993 -1994 – see Appendix 3. This was the stage at which the MENO name for the project was first used – see UCLES (1993a; 1993b).

In addition, for each of the six components of MENO there was a booklet containing information about the skill, a sample paper, and either sample responses with comments for the essay components or the answer keys and explanations as to why the right answers were correct for the multiple-choice components. Work was also begun on preparing student support materials for the skills of Understanding Argument, Literacy, and Numerical and Spatial Operations.

The construction of the pre-tests was changed for the 1993 pretest. Each pre-test now contained thirty or thirty two items and consisted of either Formal or Informal Reasoning questions. A number of anchor items from previous pre-tests were included in each pre-test and the last few items in each pre-test were used as the first few items in another pre-test as a means of investigating whether there was any evidence of a practice effect. Pre-testing in this format continued for the remainder of the project, although after three years there was no evidence of any practice effect and the placing of items at the pre-test stage did not appear to be statistically significant.

Since the beginning of the project, the names of the components had been constantly discussed. The emergence of the component names and those finally adopted are given in Appendix 1.

During the summer preparations were made for a conference to launch Thinking Skills.

7 Autumn 1993 - Autumn 1994

October 1993 saw the first MENO conference. This was held in Birmingham and was attended by a wide range of people including academic staff from both Higher and Further Education as well as representatives from bodies such as the Police Federation, the Fire Service Training and firms such as Price Waterhouse. Speakers included UCLES staff, representatives from the institutions involved in piloting, members of the Steering Groups and the 'examiners' for the six components. Presentations were made on the development of the various components and workshops were held on the various aspects of MENO including the components.

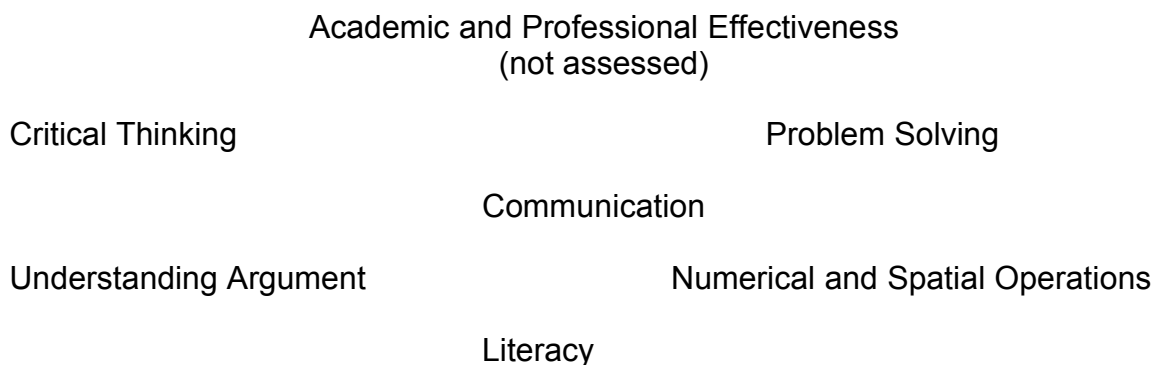
Details of the scheme as it was then are given in UCLES (1993a).

It had become clear during 1992/1993 that an earlier suggestion of a fixed date test (HEAT) and a Profile (AAP) with differing components was not what was wanted. Instead, an 'umbrella' title, MENO Thinking Skills, would be used and it would be offered in two ways. Assessments for each component would be offered as a test to be given on a fixed date and a different version of each component would be offered to institutions to administer themselves. Although the questions and tasks would be the same the two methods of administration would be different. A pilot of this new MENO Service took place in the autumn of 1993 and item writing and production of new materials continued.

In April 1994 a conference on Critical Thinking was held at the University of East Anglia. This was a jointly funded event by the University's Critical Thinking Research Centre and UCLES. The majority of the delegates were involved in education in the UK. Several presentations on MENO were made by a variety of speakers including research and development staff from UCLES and examiners. The conference resulted in considerable publicity, including an article in the Times Education Supplement and this generated a large number of enquires about the project (Young, 1994).

During the early summer term a pilot project using all six MENO components was conducted with students at the University of Westminster and an evaluation was carried out by UCLES research staff.

The structure of the MENO Thinking Skills service, at this stage was as follows:



Training of examiners for the marking of the essay components was carried out, with double-marking and inter-marking reviews being conducted.

Minor revisions to the MENO booklets were also made from experiences gained in the early stages.

8 Autumn 1994 - December 1995

During this period little further development work on the skills assessed by the components was carried out. Reviews of procedures in terms of essay marking continued together with the training of new item writers.

By the end of 1995 the sub-skills within the Problem Solving component had been revised and re-named. Whilst still based on Sternberg's triarchic theory it was thought that clarification for both item writers and users was essential. The re-naming was as follows:

Selective Encoding	became	Relevant Selection;
Selective Comparison	became	Identifying Similarity;
Selective Combination	became	Finding Procedures.

The main activity at this time concerned the basic skills and the involvement of the FE sector. Rotherham College of Arts and Technology took part in a Further Education Funding Council (FEFC) project to look at basic skills and discussions took place with the FEFC concerning funding for colleges who wished to use the project. The project did succeed in obtaining such funding and this information was made available in a MENO 'flyer'. This flyer became part of the publicity material for MENO as efforts were being concentrated on publicising the project, mainly in the UK.

Discussions with the Universities and Colleges Admissions Council (UCAS) also took place. The Law Studies Test was a qualification that applicants could include on their UCAS form and the MENO Service (fixed date) was also included.

It was decided that a video of the MENO project would be a useful tool to provide information and publicity on the project. The UCLES video unit agreed to produce a video and during the spring and summer of 1995 filming of the video began. A range of users and potential users of the service including staff and students were filmed. These ranged from sixth formers through FE, HE and a firm which recruited graduates. The video also included information about the test production process from item writing through pre-testing to item analysis. The presenter of the video, Nigel Warburton, a lecturer at the Open University, had been involved with the Critical Thinking aspect of the project since his postgraduate days in Cambridge. Filming was completed by the end of 1995.

During the early summer of 1995 discussions began with a representative of the University of Antwerp concerning the use of MENO. Admission to university in Belgium did not require formal entry qualifications and large numbers of students either dropped out of university or failed their first year examinations. The government was looking for ways that would provide some way of altering this situation. It was agreed that the University of Antwerp, the Catholic University of Brussels and the University of Louvain (all Flemish universities) would pilot two of

the components (Problem Solving and Critical Thinking) with first-year undergraduates during their first full week at university. Representatives of the three universities came to Cambridge and together with UCLES staff constructed question papers. The Critical Thinking paper would contain a small number of Understanding Argument questions to be followed by Assessing Argument questions but the Problem Solving paper would be as provided for the UK centres. Care was taken to ensure that the questions were suitable for the Belgian candidates in terms of content, and some editing of items took place. Some sample material for the candidates was provided. Both the sample material and the question papers were translated into Flemish by the Flemish universities. It was agreed that the universities would undertake their own research and follow up the students through their courses. The piloting was held in early October and was conducted in the presence of an UCLES representative.

Discussions also began with a college for blind students about how the papers, especially the Problem Solving and Numerical and Spatial Operations components, could be adapted for use by their students.

During the autumn of 1995 the first in-service (INSET) training events for teachers were held, and presentations were made at various events and conferences, including FEU events.

9 January 1996 - December 1998

By 1996 the format of the MENO Service had become well established and no further major changes were made to the components or subcomponents. The structure was as follows:

(Academic and Professional Effectiveness)

Critical Thinking

Assessing Argument

Critical Evaluation

Further Argumentation

Problem Solving

Relevant Selection

Identifying Similarity

Finding Procedures

Communication

Discrimination

Re-presentation of Material

Understanding Argument:

Recognizing Arguments

Identifying Reasons

Identifying Reasons

Numerical & Spatial Operations

Number Concepts

Numerical Operations

Quantities

Space & Spatial

Reasoning

Generalisation

Tables & Graphs

Literacy

Reading

Discrimination

Quality of Writing *Mechanics of Writing*

It had become apparent during the previous two years that two of the components, Problem Solving and Assessing Argument, were the only two components taken by candidates doing the fixed date test. These were two of the original three components which had formed part of the Higher Studies Test and were intended for admission to HE. Generally the fixed-date test at this time was taken by sixth formers who wanted to include the results on their UCAS application forms. Both HE and FE institutions were using a combination of six components as part of their own admissions process.

Discussions had also taken place with various centres, including pre-test centres, about the possibility of producing a single test that would assess equal numbers of Problem Solving and Assessing Argument items. It was decided that this test, to be known as the Cambridge Thinking Skills Certificate would replace the MENO fixed date assessment and a small scale pilot paper was tried out along with the pre-testing of new items during the late spring of 1996. The results would be reported as an overall result and the results of the two components would also be reported separately. Any significant difference between the two components would be commented on.

In April 1996 a further Thinking Skills Conference was held at the University of East Anglia. Although there were delegates and speakers from overseas this was conference was not part of the international conference series (like the ones held in Singapore in 1997 and Harrogate in 2002). Presentations on MENO and the Cambridge Thinking Skills Certificate were made and a version of the video was also shown.

The MENO video was launched in May (UCLES, 1996). The intention was that the video would be used for promotional purposes at MENO presentations, with centres being able to borrow a copy if they so wished.

In May 1996 discussions were held with the Ministry of Education in Singapore concerning the piloting of MENO and the use of the Cambridge Thinking Skills Certificate with A-Level students. It was agreed that candidates would take the Certificate and either a Problem Solving paper or a Critical Thinking paper shortly before they sat their A Levels in October/November. It was agreed that UCLES would undertake research comparing the students' Thinking Skills results with their A-Level results.

INSET events for teachers were held in the UK during 1996 and in addition to presentations on the administration and background to the development of Thinking Skills, the examiners for Problem Solving and Assessing Argument conducted 'workshop' sessions.

The first Cambridge Thinking Skills Certificate examination was held in November 1996 with a small number of students.

In December 1996 work began on the development of a new Advanced Subsidiary (AS) in Critical Thinking for the UK. This had to meet the requirements of the Qualifications and Curriculum Authority (QCA) and a syllabus and sample papers were to be provided for April 1997.

During the spring of 1997 work on the AS development continued, further INSET events were held and presentations made at Further Education Development Agency (FEDA) events.

The results of the Singapore trial were evaluated within UCLES (Massey, 1997) and preliminary results from the Belgian Universities' trials were available.

In Belfast a sixth-form law conference was held and a member of UCLES staff made a presentation to students and staff, provided a workshop for students, and held a question and answer session for teachers and UK Law School admissions tutors.

Two members of UCLES staff spent time in discussions with the Singapore Ministry of Education concerning the results of the pilot and planning a further, larger scale pilot for the autumn of 1997. At the end of this period, the staff participated in International Conference on Critical Thinking being held in Singapore where a poster presentation was made.

As a result of discussions with the Singaporean Ministry, as well as feedback from centres in the UK plans were made to revise the Critical Thinking essay mark scheme and work began on this during the summer.

Discussions took place with the UCLES representative in Argentina and admissions staff at one of the Cambridge Colleges concerning the use of the CTSC a part of the admissions process for students from Argentina. This would involve only a small number of candidates and would be administered by the UCLES representative. A paper was prepared, marking conducted in UCLES and the results forwarded to the college by the beginning of December.

In September a visit was made to Brussels to discuss the results of the trial that had taken place in the Flemish Universities. The first-year examination results for the students who had taken part were available and the researchers in Belgium had carried out an extensive evaluation. This work is summarised in (Nonneman, et. al. 1995).

The Junior colleges in Singapore conducted a second pilot of Thinking Skills in September 1997. This was again with the A Level students immediately prior to their A Levels.

Work continued on the development of the UK AS Critical Thinking syllabus and a pilot papers was compiled.

In the spring of 1998 work continued on the writing of a mark scheme for the Critical Thinking questions that required extended answers. Item writing and pre-testing for CTSC continued together with preparation of new material for the MENO Service.

For the first time candidates in South Africa entered for the CTSC examination and UK entries for the March examination were received from comprehensive and grammar schools, sixth form and FE colleges and a Young Offenders institution.

In Late 1998, UCLES underwent a substantial re-organization and there was substantial movement of staff between projects. The work on MENO did not survive these changes although the assessment of Thinking Skills continued to be developed.

Cambridge International Examinations (CIE) continued to offer the CTSC twice a year until 2000 when it was discontinued in favour of a new award, the Cambridge Award in Thinking Skills (CATS) and an A/AS award in Thinking Skills. Paper 1 of this award was very similar to the previous CTSC examination and was the CATS award but the addition of a Paper 2 that required extended answers from candidates made the whole into an AS award. These awards ran from 2000 to 2004, when a further change enables candidates to achieve an A-Level in Thinking Skills (CIE, 2004).

At the same time, since the interest of the QCA in an AS in Critical Thinking in 1996 there had been a growing interest in introducing Critical Thinking to the curriculum in schools in the UK. As a result, and after trials with a number of question types in 1999 and 2000, there is now an AS award in Critical Thinking (OCR, 2004) that has been available since 2000. An Advanced Extension Award (AEA) has also been available since 2003 (OCR, 2003) and an A-level, which builds on the modules from the AS award, will be available from 2006 (OCR, 2004).

There is, however, a major difference between these two (sets of) assessments. The OCR awards are for UK students and cover Critical Thinking only while those for CIE are for the international market and cover both Critical Thinking and Problem Solving, thus continuing the concept of the awards from the CTSC and CATS.

Within the University of Cambridge, the existence of the CTSC was known and it was thought that the types of questions that were being used were such that they could be used to provide useful additional information to those involved in the university admissions process in Cambridge. As a result, a small-scale trial was undertaken in one subject in 1999 (one College) and 2000 (two Colleges) using a CTSC question paper.

The trial concluded that an assessment of Thinking Skills could provide results that could be valuable to University Admissions Officers and could usefully have assessments of both Problem Solving and Critical Thinking.

Before the results of the trial had been fully reported, discussions were held with UCLES and it was decided to build on the work to date by developing further tests for trial to provide extra information to those administering the process of admissions. It was from these continuing developments that the TSA was born in 2001 (see Willmott, 2005; Fisher 2005).

The numbers of students taking TSA has grown steadily since 2001 when it was taken by 289 applicants. In 2002, 472 applicants were tested, by 2003 this had risen to 1551 and in 2004 some 2147 applicants from the UK and overseas were tested. Details of this assessment can be found at <http://tsa.ucles.org.uk>.

Around 1997/8, other developments within the University led to a trial of a different form of admissions test for students. In this case, there was a need to find ways of relieving the pressure on selection of applicants wishing to follow medical and

veterinary courses. Some of those involved in this work had also been involved in the work that led to MENO and this new test, which had three parts, contained one part that an assessment of Thinking Skills. By 2004, over 4000 applicants for a number of Universities were sitting the BMAT test. Details of this assessment can be found at <http://bmat.ucl.ac.uk/practice>.

Appendix 1

Names of the Thinking Skills Components

During its history the components forming the assessment of Thinking Skills had a variety of names. As the project developed, it was thought that the names of the components should more closely reflect the skills/tasks involved. It was also thought that the names of some of the components might be off-putting to some candidates. 'Mathematical Reasoning', for example, suggested that mathematics was involved in the reasoning whereas the skill was reasoning in a mathematical/numerical context.

The table below gives a summary of the skill names used and their development.

Initial Skill Name	Other Skill Name	Final Skill Name
Logical Reasoning	Informal Reasoning	Critical Thinking
	Assessing Argument	
Mathematical Reasoning	Formal Reasoning	Problem Solving
Communicative Skills		Critical Writing
Numeracy		Numerical and Spatial Operations
Task-Directed Writing		Communication
Understanding Argument		Understanding Argument
Literacy		Literacy

Thus, only in two cases, Understanding Argument and Literacy, were the component names unchanged during the life of the project.

Appendix 2

Membership of the Steering Groups: 1990-1992

Communicative Skills

Mr Ian Bryant University of Southampton
Mrs Elaine Derbyshire Nottingham Polytechnic
Dr John Foulkes UCLES
Ms Clare Goymer Polytechnic of North London
Mr Keith Guest Luton College of Higher Education
Mr David Nightingale University of Kent
Dr Sue O'Brien Anglia College of Higher Education

Logical Reasoning

Mr Alec Fisher University of East Anglia
Dr Ian Forbes University of Southampton
Dr Daryll Grantley University of Kent
Mr Paul Periton Nottingham Polytechnic
Ms Jennie Somerville Polytechnic of North London
Dr Sue Thompson UCLES
Dr Anne Thomson University of East Anglia

Mathematical Reasoning

Mr Jeffrey Goodwin Anglia College of Higher Education
Mr John Hamilton UCLES
Dr John Marriott Nottingham Polytechnic
Dr Bryan Orman University of Southampton
Mr David Phillips Polytechnic of North London
Ms Beatrice Shire University of Kent
Dr Johannes Siemons University of East Anglia

Bias (Fairness)

Dr Mary Abbott Anglia College of Higher Education
Ms Clara Connolly Commission for Racial Equality
Dr Ian Forbes University of Southampton
Dr Daryll Grantley University of Kent
Mr Alastair Pollitt UCLES
Ms Teresa Smart Polytechnic of North London
Dr Sue Thompson UCLES
Dr Anne Thomson University of East Anglia

Appendix 3

MENO Thinking Skills Service: Papers and Publications

Note on Availability

This Appendix refers to a wide variety of old project documents, many of which are no longer available. As with the References, the availability of each is indicated by the category into which each one falls. In the list below, the category is indicated by a bold, capital letter **A**, **B**, **C** or **D**.

Category A

Reference to an existing publication or document that may be obtained in the usual way (e.g. from libraries, bookshops, etc.).

Category B

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<http://www.ucles.org.uk/????????>

Category C

Reference to a document held in electronic form, in either Adobe pdf or MSWord format, and which may be downloaded from the UCLES website under the Assessment Directorate's section listing older (archive) documents of interest.
[http:// www.ucles.org.uk/????????](http://www.ucles.org.uk/????????)

Category D

Reference to an old UCLES project document that is no longer available.

General Documents

The following documents are known to have been produced during the life of the MENO Project. The first few documents are related to the Law Studies Test which predates the MENO work but which provided a base for that work.

Handbook to the Law Studies Test (1984). **D**

Law Studies Test: Handbook and Sample Test (undated). **D**

Law Studies Test: Guide to Writing and Editing Logical Reasoning Items (undated). **D**

Law Studies Test: Guide to Writing and Editing Analytical Reasoning Items (undated). **D**

Discussion Paper and Information for Staff in Educational Institutions - Pilot

Scheme 1992 – 1993: September 1992. **D**

Administrative Arrangements for Educational Institutions - Pilot Scheme 1992-1993: September 1992. **D**

Handbook for Students and Applicants to Educational Institutions with Specimen Questions - Pilot Scheme 1992-93: September 1992. **D**

The MENO Thinking Skills Service 1993 - 1994: Development and Rationale (1993). **C**

Student's Guide (Pilot Scheme 1993 - 1994): September 1993. **C**

Assessing Thinking Skills – Flyer (1993). **C**

Administrative Arrangements for Educational Institutions (Pilot Scheme 1993-1994): September 1993. **C**

Draft Test Material for a Higher Studies Test: A Consultation Document: Document (undated) prepared by UCLES. **D**

Information Booklet for Students: 11 February 1994. **C**

Quick Guide to the Components: 15 March 1994. **C**

Office Handbook: May 1995. **C**

Distance Training Pack (undated). **D**

Cambridge Thinking Skills Certificate – Information Leaflet (1996). **D**

Cambridge Thinking Skills Certificate – Guide to the Award (1998). **D**

Guide to Writing and Editing Problem Solving Items: August 1997. **C**

Guide to Writing and Editing Assessing Argument Items: August 1997. **D**

Guide to Ensuring Fairness: September 1997. **C**

The MENO Thinking Skills Service: An Introduction: May 1997. **C**

MENO: The Thinking Skills Service. VHS Video: Cambridge Video Unit (1996). **A**

MENO Series of Documents

The following documents were prepared for use during the project.

MN01 MENO Thinking Skills Service: Introduction **C**

MN02 MENO Thinking Skills Service: Leaflet **D**

MN11 Improving Your Literacy Skills **C**

MN12 Improving Your Numerical and Spatial Skills **C**

MN13 Improving Your Skills in Understanding Argument **C**

MN14 Improving Your Communication Skills **D**
MN21 MENO Skills Service: Sample Assessment Materials with Answers **D**
MN22 MENO Skills Assessment: An Introduction for Students **C**
MN23 Critical Thinking: Preparing for the Assessment **C**
MN24 Problem Solving: Preparing for the Assessment **C**
MN25 Literacy: Preparing for the Assessment **C**
MN26 Numerical and Spatial Operations: Preparing for the Assessment **C**
MN27 Understanding Argument: Preparing for the Assessment **C**
MN28 Communication: Preparing for the Assessment **C**
MN31 Guide to the Assessment of Literacy **C**
MN32 Guide to the Assessment of Numerical and Spatial Operations **C**
MN33 Guide to the Assessment of Understanding Argument **C**
MN34 Guide to the Assessment of Communication **C**
MN35 Guide to the Assessment of Critical Thinking **C**
MN36 Guide to the Assessment of Problem Solving **C**
MN39 MENO Thinking Skills: Guide to the Institutional Service **C**

Appendix 4

Assessment and Administration

The Thinking Skills project began to provide an assessment tool which could be used in Higher Education to screen non-standard applicants. It would be used in HE as and when required and would be provided by UCLES in an 'off-the-shelf' format. For each component the following material was provided in form that allowed it to be photocopied for use:

'Preparing for the Assessment' - a booklet containing teaching material with sample assessment and answers

Two sets of assessment material with detailed marking and grading instructions, mark sheets, answer sheets etc.

General introductory material including an 'Introduction for Students' and 'Improving your Skills' booklets which contained guidance and practice exercises for students

In addition to 'masters' of question papers, detailed guidance on marking the essay components would be provided together with keys to the multiple-choice papers as well as information and specimen papers for candidates. Centres could subscribe to any or all or any combination of the six components. This model became the MENO Thinking Skills Service

Some centres, however, wanted an assessment tool that would be marked at UCLES and the results sent back to them. This model became the MENO Thinking Skills fixed date assessment and was run in the same way as most other UCLES examinations.

Throughout most of the MENO project this was the administration system. Centres that signed up for the MENO Service paid an annual fee and were provided with two different forms of the assessment for each component. They were able to use the assessment material as and when they wanted. Two new forms of assessment were available at the beginning of each academic year for new centres and those which renewed their subscription.

As the project developed and sixth forms became more interested in the assessment the fixed date examination became more widely used. Candidates who were applying for university were able to put the results on their UCAS application forms.

The Cambridge Thinking Skills Certificate which replaced the MENO fixed date examination was offered twice a year in March and November with candidates typically sitting the examination in March of their first year in the sixth form. Overseas candidates however were more likely to take the examination in November.

Appendix 5

Reporting Results

Throughout the history of the Thinking Skills project it was considered important that the results of the assessment should offer guidance and support to both candidates and centres.

The Academic Aptitude Profile, as the name suggests, was intended to provide a profile of students' skills and aptitudes. The 'MENO Scale' was developed by Alastair Pollitt (UCLES) to report results. The intention was that the MENO assessments would provide a scale, which would become familiar to those who used it. MENO was not intended to be either norm referenced or criterion referenced test but a measurement system. An example of the scale or profile as it became known can be found in the MENO booklet 'Thinking Skills Service 1993-1994: Introduction'.

In addition to a profile for the six components there were profiles of the sub-skills within each component. So, for example, a candidate who did the Critical Thinking and Problem Solving components would receive a profile with an overall scale for each component and three sub-scales for each components (there being three sub-skills for each of those components). A profile might show that a candidate who did Problem Solving was better at Selective Combination than Selective Comparison and better at Selective Comparison than Relevant Selection.

For staff and students within FE, the profile of skills and sub-skills was found to be very useful. It provided guidance information that was helpful in ensuring that students were both on the right courses and the right level of course.

When the Cambridge Thinking Skills Certificate was introduced results were also reported on a scale. The profile for each candidate gave the following information: (the numbers are only for illustration purposes)

"Your overall ability is estimated to be 83. On the sub-component called Assessing Argument your ability is estimated to be 79. On the sub-component called Problem Solving your ability is estimated to be 87. The difference is not large enough to be considered significant."

It was also reported that:

50 per cent of all students showed a difference of less than 4.0; such small differences were not judged to be significant.

75 per cent of all students showed a difference of less than 7.0: differences of greater than 4.0 but less than 7.0 were judged to indicate information that might be useful in planning course and careers.

95 per cent of all students showed a difference of less than 13.0; differences of greater the 7.0 but less than 13.0 were judged to be considered significant"

A few candidates did achieve very different scores on the two components. For a candidate who, for example, was thinking of doing Law it was probably far better to have a good score on the Critical Thinking component rather than on the Problem Solving Component rather than the other way round. However, good scores on both components were generally a target for all candidates.

Appendix 6

The Project Names

Project Names

In 1990 the Thinking Skills project was developing a test known as the Higher Studies Test. In 1991-1992 consideration was given to other names including the Higher Education Aptitude Profile (HEAP) and the Academic Aptitude Profile (AAP). Eventually, the name MENO was agreed. This name was given to the tests developed by the project from 1992. In 1996 the Cambridge Thinking Skills Certificate (CTSC) was developed from the MENO materials and this operated until March 2000.

The MENO Name

Meno was a pupil of Socrates who, in the course of a discussion on the acquisition of 'virtue', prompted Socrates to propound his theory of knowledge as recollection. This theory held that knowledge is inherited and is a natural component of the mind. When Meno asked for a demonstration of the art, Socrates proceeded to lead a young slave through a series of questions to the solution of a mathematical problem. In this experiment, Socrates claimed not to have told the slave anything, but to have elicited knowledge which the slave already possessed.

The aims of the MENO Thinking Skills Service were to identify and develop Thinking Skills which individuals possess, and to encourage employers and educational institutions to recognize and reward those skills.

References – Note on Availability

In preparing this report, a wide variety of documents has been drawn on including many old project documents, many of which are no longer available. The references in the text are provided as usual and each one falls into one of four categories. In the list of references below, the category into which each one falls is indicated by a bold, capital letter **A**, **B**, **C** or **D**.

Category A

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Category D

Reference to an old UCLES project document that is no longer available.

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