

# TOPOGRAPHICAL MAPWORK IN GEOGRAPHICAL EDUCATION

**DESMOND A. GILLMOR**

*Department of Geography, Trinity College Dublin*

and

**SHELAGH B. WADDINGTON**

*Department of Geography, Trinity College Dublin*

*Department of Geography, St. Patrick's College, Maynooth*

**Abstract.** Topographical mapwork has a strong position in the syllabi and examinations in second-level education in the Republic of Ireland. It has not been the subject of any research, however, so a questionnaire survey of geography teachers was undertaken to investigate aspects of its nature and problems. It receives less teaching time and resources than its role in assessment might suggest. Mapwork was considered to be comparatively easy to learn, relative to other sections and skills in the syllabi, but considerable differences in the level of difficulty of various topics within mapwork were perceived. Problems in teaching and learning topographical mapwork are discussed.

## Introduction

The place of topographical mapwork became firmly established in geographical education at second level in the Republic of Ireland in the 1960s and 1970s but it has not been the focus of any research. In a review of the use of maps in geography, Horner (1989) included two paragraphs on their role in Irish second-level geographical education. O'Byrne (1986) conducted a questionnaire survey of 1,792 senior students at 28 schools in the Dublin and Limerick areas to investigate attitudes towards geography, and this included a question concerning the popularity of activities in geography. While going on fieldtrips was far ahead of other activities in interest level, studying Ordnance Survey maps ranked second equally with working in a group as a member of a team. She concluded that the use of maps in the field and in the classroom generates interest and motivation in students. She found that there was a greater preference for mapwork amongst boys than girls, as did Langan (1991) in a small study.

In the absence of other research, the Working Group on Map Skills of the International Geographical Union (IGU) provided a welcome catalyst and stimulus to undertake the study of the situation in the Republic of Ireland reported here. The Working Group had been established by the IGU Commission on Geographical Education at Sydney during the 1988 Congress of the IGU in Australia. Its

purpose was to undertake an international investigation of the problems of interpreting topographical maps in second-level schools. It was expected that this would be presented as a report to the next IGU Congress in the United States of America in 1992, the Commission meeting being at Boulder, Colorado. The invitation to participate in the international study by investigating the situation in the Irish Republic came in 1991 from the chairperson of the Working Party, Dr. Julie Okpala, Department of Education, University of Nigeria, Nsukka, Nigeria. Unfortunately sufficient countries did not participate in the project to make the production of a report for the Boulder meeting feasible.

The objectives of the study were to investigate the role of mapwork in the syllabi and examinations, the time and resources devoted to mapwork, the difficulty of mapwork relative to other parts of the syllabus and other geographical skills, the relative difficulty of topics within mapwork, and the general problems relating to mapwork teaching and learning, including any gender differences that might exist.

### **Mapwork in the Syllabi and Examinations**

Description of the place of topographical mapwork in the syllabi and examinations is facilitated by the fact that in the highly centralised and examination-oriented educational system of the Republic of Ireland students throughout the country and in all types of schools study the same syllabi in individual subjects and take the same examinations. The first three years of the second-level curriculum, comprising the junior cycle, ended with the Intermediate Certificate public examination until this was replaced by the Junior Certificate examination from June 1992. The new Junior Certificate syllabus in geography is concept-based and it emphasises skills and values. The Intermediate Certificate is relevant to this study, however, because it was still in existence when the survey was undertaken, because teachers have a high degree of familiarity with it through following the Intermediate syllabus for many years and because the teaching of topographical mapwork has not changed abruptly with the introduction of the replacement Junior Certificate syllabus.

In the Intermediate Certificate syllabus, topographical mapwork was contained within a practical geography section and it was stated to involve the simple interpretation of Ordnance Survey maps at scales of 1:126,720, 1:63,360, 1:10,560, 1:2,500 and 1:1,000 (Department of Education, 1989). This was specified as involving measurement, scale, representation of relief, local plans and maps, grid references and direction. In the examination there were two questions on mapwork, generally one based on a 1:126,720 map, which is the standard topographical map in the Irish Republic, and one on an urban 1:1,000 or 1:2,500 map. These questions and two on physical geography were within a section of four questions from which two had to be answered, candidates being required to answer a total of five questions in the examination on the standard syllabus. The mapwork questions were very popular, with 82% of candidates choosing the question on the 1:126,720 map in the period 1988-90 and 74% doing the one on the town plan. The mapwork

questions were answered substantially better than the other questions in this section.

In the new Junior Certificate syllabus, mapwork is one of the specified practical skills (Department of Education, undated). The requirements are similar to those for the former Intermediate Certificate but include also identification of simple geographical relationships, relating maps to photographs and other sources of information, forming generalisations from map data and recognising the comparative limitations of maps for different purposes. The precise role and nature of mapwork in the examination could not be assessed by teachers prior to June 1992 as a sample paper had not been issued but some sample questions were given and these included mapwork. In the 1992 examination, both the higher and ordinary level papers contained one question on mapwork in section two of the paper, candidates having to answer three out of the five questions in this section at both levels. The map extract given was of the Coleraine area on the scale of 1:126,720. In addition, amongst the twenty short compulsory questions in section one of the papers, to which two-fifths of the marks are allocated, there were four questions on the higher level paper and three on the ordinary level paper relating to mapwork.

Mapwork has a prominent place in the senior cycle of Irish second-level education, with a separate section in the Leaving Certificate syllabus which is studied for two years. There is one compulsory question on topographical maps out of the total of four questions to be answered in the terminal Leaving Certificate examination. Study of the same scales of maps as for the former Intermediate Certificate is specified but the examination question is almost always based on a 1:126,720 map extract. In addition to the basic map reading skills and extending beyond Intermediate Certificate requirements, the Leaving Certificate syllabus specifications include interpretation of the physical landscape based on recognition of landforms and drainage patterns, interpretation of man's imprint on the landscape, and written descriptions with illustrations and sketch maps indicating major relationships (Department of Education, 1989).

## **Method of Data Collection**

Given the necessarily pilot nature of any investigation of mapwork in Irish geographical education and the limited time and resources available, a postal questionnaire survey of teachers seemed the obvious primary method of data collection. It was felt that teachers, in addition to giving their own views on teaching mapwork, would be able to assess accurately the difficulty or ease experienced by students in learning mapwork, and also that the teaching and learning are obviously interconnected. In some respects, teachers might be better aware of the difficulties and deficiencies of students than would the students themselves. As each teacher would have knowledge of many students over a varying length of time, a much greater number and variety of experiences could be tapped than through the type of student survey that might be feasible. The questionnaire survey was supplemented by informal discussions about mapwork with some teachers and examination markers known to the authors.

The questionnaire sought, as background material, information on the type and size of school and on the gender and teaching experience of the teacher. A section assessing the resources used comprised questions relating to textbooks, maps of the school area, class sets of maps and other resources used in teaching mapwork. Quantitative assessment of the ease or difficulty which students have in mapwork was sought in two questions which compared mapwork with other parts of the geography syllabus and with the other skills listed in the Junior Certificate syllabus, and in one question which listed twenty individual mapwork topics which are specified in the various syllabi or are asked in the examinations. Teachers were asked to indicate the difficulty which junior cycle students of average ability experience in learning each of the parts, skills and topics, using a score 1 for very difficult, 2 for difficult, 3 for easy and 4 for very easy. Investigation was at the junior cycle level as that is when most of the basic mapwork learning is done, with senior cycle work being an extension and treatment at greater depth. One question explored opinions concerning the relative difficulties in mapwork experienced by boys and girls. In two final open-ended questions, teachers were asked respectively about any difficulties experienced by students in learning mapwork at Leaving Certificate level and about any problems which they themselves have in teaching mapwork in general at second level.

There is no register of geography teachers in the Republic of Ireland which could be used as a sampling frame. As a substitute, names and addresses were taken from the membership lists of the Association of Geography Teachers of Ireland (AGTI) which has branches throughout the country. These are probably the more committed geography teachers with greater than average involvement in teaching geography. Questionnaires were sent to 75 teachers in as many different schools and completed ones were received from 46, a response rate of 61%. There were 24 female respondents, 21 male and 1 unspecified. The numbers of schools represented were 30 secondary, 8 vocational and 8 community and comprehensive. These had a total student enrolment of 25,886, representing 8% of post-primary students in the country.

## Results and Interpretation

The mean numbers of minutes per week devoted to geography were 118 in junior cycle and 185 in senior cycle. These figures of two and three hours respectively represent three class periods at junior cycle, though a few schools have only two in some years, and four class periods at senior cycle in some schools and five in others. The time allocation to geography in the junior cycle was slightly higher than average in the secondary schools.

The mean percentage of geography teaching time spent on mapwork was 15 in junior cycle, being 16, 11 and 17 in the first to third years respectively. These figures may be taken to suggest that mapwork tends to be dealt with proportionately more at the beginning of the course and coming towards the examination at the end.

Also they might be interpreted as indicating some slight diminution in the importance attached to mapwork in teaching the new Junior Certificate syllabus in its first two years. The teaching time allocation of 15% to mapwork may be compared with the average of approximately 31% of the assessment opted for by candidates through their preference for the mapwork questions in the Intermediate examination. It is evident that the role of mapwork in teaching is substantially less than that in assessment under the Intermediate Certificate system and even less than in the Junior Certificate to date. This applies also in the senior cycle, where 16% of teaching time is devoted to mapwork but there is a compulsory 25% of assessment in the Leaving Certificate examination. Furthermore it seems possible that teachers, in responding to a questionnaire on the teaching of mapwork, overestimated the proportion of time which they devote to it. Also mapwork is the part of the geography course which is dealt with largely during class time in school, so that it is probable that it occupies a very small proportion of the students' own study time.

With regard to the resources used in teaching mapwork, two-thirds of respondents stated that they used a textbook. The books were almost all general geography textbooks which include mapwork, with the only use of specialist mapwork books being by sixteen teachers at senior cycle level. The proportions of schools having maps of the school area at different scales were: 1:126,720, 80%; 1:10,560, 67%; 1:2,500, 57%; 1:1,000, 54%. These proportions reflect the relatively low emphases placed on local studies and fieldwork in geography teaching and in the examinations, together with the types of maps used in the examinations and the high costs of large scale maps. Three-quarters of schools had class sets of map sheets or map extracts at the 1:126,720 scale but only one-quarter of schools had class sets at the other scales. Those schools not having class sets of maps presumably rely on the few map extracts included in the textbooks. One-half of respondents stated that their schools had other resources used in teaching mapwork. The most commonly quoted ones were overhead projectors by seven teachers and slides and compasses by four teachers each. Opisometers were mentioned by only two and computer programs by one. Thus the general picture which emerges is one of resource deficiency in the teaching of mapwork.

The overall rating of difficulty in learning different sections of the geography syllabus by junior cycle students of average ability on the scale of 1 for very difficult to 4 for very easy was: climate, soils and vegetation 1.72; geomorphology 2.10; regional geography 2.53; mapwork 2.64; human geography 2.98. Thus only human geography was considered to be easier to learn, though the advantage over regional geography was slight. The main difference by school type was that teachers in vocational schools rated mapwork as somewhat more difficult to learn, with a score of 2.25, ranking it as much less easy than regional geography (3.0).

The difficulty rating scores for the learning of skills were: using statistical tables, 2.08; using other maps such as choropleth maps, 2.24; using figures and diagrams, 2.58; using Ordnance Survey maps, 2.59; using photographs, 2.99. Thus topographical maps were ranked second easiest for students of average ability to learn, after the use of photographs, but almost equal with the use of figures and diagrams.

There was no significant variation by school type in the perception of topographical mapwork relative to other skills.

The mean scores for the difficulty rating of the twenty mapwork topics are given in Table 1. Differentiation was greatest at the lower end of the difficulty scale, where the equally-ranked reading of spot heights and recognition of symbols and, to an even greater extent, the measurement of straight distances, were rated between easy and very easy. These were considered substantially easier to learn than the other mapwork topics. At the other end of the scale, seven topics were rated more than difficult, with the calculation of gradients and the recognition of landforms from contour patterns being considered to be substantially the most difficult.

**Table 1. Difficulty ranking and scores for the learning of mapwork topics by junior cycle students of average ability, as assessed by teachers (1 is very difficult, 2 difficult, 3 easy and 4 very easy)**

1.	Calculate gradient	1.42
2.	Recognise landforms from contour patterns	1.48
3.	Understand cross-section diagrams	1.61
4.	Interpret placenames	1.74
5.	Interpret the influence of the physical landscape	1.79
6.	Orient the map in the field	1.88
7.	Relate maps to photographs	1.93
8.	Use compass bearings	2.05
9.	Read heights between contours	2.11
10.	Interpret human features, e.g. settlement	2.23
11.	Calculate map areas	2.35
12.	Understand scale	2.40
13.	Draw sketch maps	2.54
14.	Measure winding distances	2.60
15.	Use grid references	2.77
16.	Use compass directions	2.89
17.	Read heights at contours	3.00
18.	Read heights at spot heights	3.30
19.	Recognise symbols	3.30
20.	Measure straight distances	3.61

The calculation of gradients was rated much more difficult than any of the constituent skills on which it is based, comprising the reading of heights, the measurement of distance and the understanding of scale. With regard to the ranking of topics which are related to one another, altitude was most easily read at spot

heights (18) but, understandably, they and contours (17) were considered to be much easier to read than heights between contours (9). Also as would be expected, students can measure straight distances (20) much more easily than winding distances (14). The use of compass directions (16) was assessed as being much more readily learned than the use of compass bearings (8) or orientation of the map in the field (6).

There was remarkable uniformity in the difficulty ratings of mapwork topics across school types. The calculation of gradients was ranked as the most difficult topic and the measurement of straight distances as the easiest in each of the three school types, with the greatest difference in rank placings for any one topic amounting to four places in relation to only two topics.

It had been hypothesised that girls might find mapwork more difficult to learn than boys. Only eight teachers felt that there was a differential in gender, six (five of them male) considering that girls find mapwork more difficult and two (both male) that boys do. Twenty-five respondents (eleven of them male) with experience of teaching both genders expressed the view that there is no difference. Some however, including teachers who felt that there was no difference overall, stated that boys and girls had varying abilities in different aspects of mapwork. The general view in this respect was that boys are better at the more mathematical aspects, including scale, measurement and calculating gradients, and at interpreting the physical landscape, while girls are neater and more artistic in their work and are more careful in their approach to interpretation. With regard to the comparisons of mapwork with other areas of the syllabus and with other skills, in each instance female teachers and teachers in girls' schools rated mapwork more difficult than did male teachers and teachers in boys' schools, though the differences in the scores were slight. Similarly with regard to the individual mapwork topics, only one-quarter were rated easier by female teachers and teachers in girls' schools. Those topics which were rated easier by teachers in girls' schools than those in boys' schools were interpreting placenames, interpreting human features, drawing sketch maps and measuring distances. Thus there was some indication that mapwork, and in particular some aspects of mapwork, may be more difficult for girls than for boys but the evidence was not conclusive.

## Discussion and Conclusion

There was a considerable degree of concurrence amongst respondents to the questionnaire concerning mapwork teaching in general, its perceived ease of learning relative to other parts of geographical education and the degrees of difficulty of individual mapwork topics. This lends support to the view that the opinions of the teachers concerning the students' learning represent the students' actual experiences. This concurrence and representation were further validated and expanded upon in the answers to the two open-ended questions concerning the learning and teaching of mapwork and in the discussions with teachers and examination markers.

Teachers and students generally have positive attitudes towards mapwork and many encounter no great difficulties. Most students enjoy mapwork but some dislike it and it may be that neutral feelings are less common than with other sectors of geography. Many can see the relevance of this practical geographical skill. It seems to be particularly beneficial for those with lower literary competence and less-able students in general, in that they can get a sense of achievement in mastering basic concrete skills. At senior-cycle level, some students tend to feel that they already know all that is necessary and the more competent ones may find mapwork repetitious. Some teachers find that this can best be overcome by integrating mapwork with the systematic and regional parts of the course. Mapwork is perceived to yield good examination rewards for the time devoted to it.

With regard to the individual mapwork topics, the discussion by teachers confirmed the results of the difficulty scoring and ranking. Teachers and examiners elaborated on the nature of some difficulties. Thus in giving grid references, students may reverse the order of easting and northing. In measuring distances and calculating gradients, the metric and imperial systems may be confused and mixed. Measuring winding distances presents difficulties for those with weak powers of concentration and coordination. In drawing sketch maps, there are problems in relation to neatness, the appropriate amount of detail and the spending of excessive amounts of time. Cross-sections are not easily understood by some and intervisibility causes difficulties. There is some confusion concerning the terms applied to settlement, including pattern, form, density, distribution, site and situation. There is the obvious difficulty in visualising the actual landscape represented on the map and especially in seeing it in three-dimensional form.

While basic map reading skills may have been acquired, the level of interpretation required at senior cycle, especially in the more discriminatory parts of questions on higher level examination papers, cannot easily be attained by many students. Some who can recognise and describe features are not then able to make deductions from them or they state only the most obvious inferences. Thus questions concerning physical-human interrelationships are often poorly answered. A very common failing in all interpretation is not to use supporting evidence from the map for statements made, though recent improvement has occurred in this respect. Questions concerning hypothetical role-playing in which the candidate is asked to make and justify decisions such as those of an industrialist or a tourist cause some problems. Questions concerning tourist attractions generate excessive writing. The interpretation of geomorphology seems to present particular difficulties and not only for those who do not take the physical geography option in the Leaving Certificate syllabus. Deficiencies include the recognition of landforms and the application of geomorphological knowledge and theory to map interpretation. A question on the Leaving Certificate higher level examination paper in 1988 requiring candidates to recognise an obvious structural trend in the landscape caused immense difficulty. Problems also arise in the division of a map into physical regions.



A particular concern of geography teachers at the time of the survey was uncertainty about mapwork in the new Junior Certificate examination to begin in 1992, including to what extent it would figure on the papers and what the expectations would be. This illustrates the difficulties for teachers when they do not have full specimen papers in advance of the examination proper.

Many teachers are concerned about the inadequacy of resources which would assist in teaching mapwork, though it is also evident that some available resources are not used to the optimum. A basic difficulty relates to the inadequate variety of maps available to most teachers and the insufficient numbers of particular maps for class use. Maps are expensive to purchase, especially those of large scale, though the Ordnance Survey of Ireland has introduced better concessionary rates on maps for educational purposes. Some teachers find that students' visualisation and interpretation of the landscape can be greatly assisted through use of models, photographs and transparencies.

Inadequacy of time available, both in teaching and learning mapwork and also in the examinations, is a basic problem. The geography syllabi are long relative to the class time allocated, even with the new Junior Certificate, so that teachers are under pressure and many feel that they have not sufficient time to devote to teaching mapwork as they would wish. This is compounded by the difficulties of large class sizes and mixed ability classes, so that many teachers cannot give the individual attention that can be so beneficial in mapwork.

Related both to the lack of time and resources, in addition to the many practical organisational problems and the inexperience of teachers, is the fact that there is totally insufficient fieldwork with which mapwork might be integrated. Fieldwork is not compulsory at any level and many teachers undertake little or none. Those whose students get at least some opportunity to use maps in the field, relating them to the landscape, find that it brings reality to mapwork and greatly facilitates map reading and interpretation. Many other teachers realise the potential contribution and feel the time constraint as a particular problem. One of the beneficial consequences of greatly increased fieldwork would be further improvement in the standard of mapwork in Irish geographical education.

## References

Department of Education (1989) *Rules and programmes for secondary schools 1987/88 to 1989/90*, Dublin, Stationery Office.

Department of Education (undated) *The Junior Certificate geography syllabus*, Dublin, Stationery Office.

Homer, A. A. (1989) Maps in geography, in R. W. Alexander and D. A. Gillmor (eds), *Geography in education in the Republic of Ireland*, Dublin, Geographical Society of Ireland Special Publication No. 4, 52-62.

Langan, E. (1991) *Attitudes and perceptions of Leaving Certificate students to geography*, unpublished B.A. thesis, Department of Geography, Trinity College Dublin.

O'Byrne, D. A. (1986) *An investigation of attitudes of pupils and teachers to geography in Irish post-primary schools*, unpublished M.A. thesis, Thomond College of Education, Limerick.