THE IMPORTANCE OF DISTANCE EDUCATION IN THE DEVELOPING WORLD*

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I. WHAT IS DISTANCE EDUCATION?

Distance education is a powerful and growing force in education at university level in a wide variety of subjects including astronomy. The main characteristic of distance education is that the student is remote from a university campus. This allows students to study at home or in the workplace. Study can be part time or full time, vocational or non-vocational.

Distance education uses a variety of media, the specially prepared, user-friendly printed text usually being central. Other media can include TV, video, and the personal computer, all of which can be located at study centers where they can be shared by a number of students.

Distance education is NOT unsupported education. Ideally, the student has a local tutor, but when tutors are in short supply, contact by telephone or by mail is vital. Self-help student groups are of great value. There can also be residential schools for a weekend or longer. At such schools supervised practical work can be done.

An important ingredient of distance education is continuous assessment—assignments that the student does throughout the course. These have an important pacing function, as well as an important teaching function.

II. ADVANTAGES OF DISTANCE EDUCATION IN THE DEVELOPING WORLD

An important advantage is that the cost of producing a graduate by distance education is lower than by traditional campus methods, as the final column of Table 1 shows. Here the cost per graduate by distance education is expressed as a percent of the cost by traditional methods. This table (Daniel 1995) lists those distance education institutions that have more than 100,000 students in degree-granting courses. In addition, there will be a large number of students in non-degree courses. Note that most of the mega-universities are in developing countries. This is also true of the smaller distance education institutions.

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A further advantage of distance education is that it enables a country to overcome a shortage of astronomers that can teach at degree level. Indeed, it is possible to run an astronomy course with no astronomers in the country at all!

III. DISTANCE EDUCATION IN ASTRONOMY

About half of the distance education institutions in Table 1 have astronomy courses. Where student numbers are large these courses can account for a large fraction of astronomy students in a country, and yet a small number of astronomy educators can prepare and administer a distance education astronomy course.

Though the printed text is a cost-effective medium, astronomy education is greatly enriched by observational work and by access to the World Wide Web. Fortunately, both of these things can be accomplished at low cost.

Non-trivial observational work can be accomplished without any special equipment at all, or with equipment that the student cannot readily acquire. Examples include:

- determining the length of the sidereal day
- measuring the solar luminosity
- estimating the photospheric temperatures of the stars
- estimating the limiting visual stellar magnitude in various conditions

and many more. To give such projects substance the student must be required to record their observations and measurements carefully, and to carry out quantitative and graphical analysis wherever possible, including estimating measurement uncertainties.

A personal computer and a modem are expensive items. However, the cost per student can be reduced if a single computer and modem (rented or purchased) is shared by many students, perhaps with the aid of a subsidy. In some cases a local school or college might be able to provide access. When the World Wide Web is available this opens up a huge range of images, information, data bases and projects, including remote observing.

IV. USING DISTANCE EDUCATION METHODS & MATERIALS ON CAMPUS

The integration of distance education methods and materials with on-campus learning can bring many benefits, as much in the developing world as elsewhere. Distance education methods and materials can help to make up for a shortfall of astronomy teachers, or allow teachers to spend more time providing tutorial support and supervising practical work. This is because distance methods facilitate self-study, using materials designed specifically for this purpose.

An obstacle to on-campus use of distance education methods & materials is that students are not used to self-study with comparatively little teacher contact. However, lack of contact is ameliorated by user-friendly, user-active texts, high quality audio-visual materials, and the systematic use of WWW material and multimedia. Distance methods have also facilitated the development of non-trivial experiments that require no specialist equipment. Therefore, distance education methods and materials can be used to great effect in on-campus astronomy courses, particularly introductory and non-specialist courses: the materials provide a structured base, and give the lecturer time to
TABLE 1.
The Mega-Universities in Distance Education (as at the start of 1996)

<table>
<thead>
<tr>
<th>INSTITUTION (alphabetical order)</th>
<th>Degree students</th>
<th>Graduates per year</th>
<th>Annual budget/ $10^6 US</th>
<th>% of budget(1) stud't fees</th>
<th>% of budget(1) gov't grant</th>
<th>Unit(2) cost/%</th>
</tr>
</thead>
<tbody>
<tr>
<td>China China TV University System</td>
<td>530 000</td>
<td>100 000</td>
<td>??</td>
<td>5</td>
<td>95</td>
<td>40</td>
</tr>
<tr>
<td>France Centre National d'Enseignement à Distance</td>
<td>105 000</td>
<td>??</td>
<td>113</td>
<td>65</td>
<td>35</td>
<td>50</td>
</tr>
<tr>
<td>India Indira Gandhi National Open University</td>
<td>242 000</td>
<td>8 000</td>
<td>10</td>
<td>30</td>
<td>68</td>
<td>35</td>
</tr>
<tr>
<td>Indonesia Universitas Terbuka</td>
<td>353 000</td>
<td>3 000</td>
<td>2.5</td>
<td>66</td>
<td>34</td>
<td>15</td>
</tr>
<tr>
<td>Korea Korea National Open University</td>
<td>196 000</td>
<td>10 000</td>
<td>48</td>
<td>62</td>
<td>38</td>
<td>10</td>
</tr>
<tr>
<td>South Africa University of South Africa</td>
<td>130 000</td>
<td>10 000</td>
<td>128</td>
<td>39</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Spain Universidad Nacional de Educación a Distancia</td>
<td>110 000</td>
<td>1 500</td>
<td>??</td>
<td>60</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Thailand Sukhthai Thammathirat Open University</td>
<td>300 000</td>
<td>13 000</td>
<td>32</td>
<td>49</td>
<td>23</td>
<td>30</td>
</tr>
<tr>
<td>Turkey Anadolu University</td>
<td>567 000</td>
<td>14 000</td>
<td>15</td>
<td>76</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>United Kingdom The Open University</td>
<td>150 000</td>
<td>17 000</td>
<td>300</td>
<td>31</td>
<td>60</td>
<td>50</td>
</tr>
</tbody>
</table>

1 Other sources make up to 100% in some cases.  2 As a percentage of conventional campus universities.

support the students individually, and develop particular topics in detail in response to individual student needs and interests.

V. ABOUT THE AUTHORS
Barrie W Jones has worked for 25 years in the Physics & Astronomy Department of the Open University in the UK, the premier institution devoted to distance education. The basic astronomy course, which is science based, enrolls 1300 students per year. Dr. Jones was co-chair of the Local Organizing Committee of IAU Colloquium 162 "New trends in astronomy teaching", held in the UK in July 1996.

Derek McNally has worked for 37 years at the University of London Observatory, part of the Department of Physics & Astronomy, University College London. He has played an active role in developing and teaching the astronomy-based degrees at UCL over that period.

VI. REFERENCE