THE USE AND HELPFULNESS OF COMPONENTS IN A FIRST GENERATION MULTIMEDIA SYSTEM A STUDY OF INDIVIDUAL DIFFERENCES

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Abstract: Use and helpfulness of course components have been selected by the British Open University as key performance indicators. To investigate whether or not greater use of components is a good thing, a study is made of the effects of institutional control over students' use of components. If there is strong institutional control it may happen that students will be forced to use a component which they find less helpful. If students are given control then they adjust their level of use in order to maintain a certain level of helpfulness. The correlation statistics exhibit clusters due to integration in the design of the components, and also clusters due to individual differences in predisposition and taste. Because predispositions and tastes exhibit a great variety of dimensions the institution needs to provide a wide range of components if it is to meet students' widely varying needs.

Résumé: L'université British Open University a identifié l'utilité et les éléments pratiques apportés par les composantes d'un cours comme étant des indicateurs clés de performance. Pour découvrir si l'utilisation d'un plus grand nombre de composantes est plus ou moins valable, une étude a porté sur les effets du contrôle pratiqué par les institutions sur l'utilisation des composantes par les étudiants. Si un grand contrôle institutionnel existe, les étudiantes peuvent être forcés d'utiliser des composantes qu'ils jugent moins pratiques. Si les étudiantes possèdent ce contrôle, ils ajustent leur niveau d'utilisation afin de maintenir un certain niveau pratique. Les corrélations montrent des groupements dus à l'intégration dans le design des composantes ainsi que des groupements attribués aux différences individuelles quant aux prédispositions et aux goûts. Puisque les prédispositions et les goûts démontrent une importante variété de dimensions, les institutions devraient fournir une grande variété de composantes afin de répondre aux besoins variés des étudiantes.

Introduction

In 1994 the British Open University formulated a set of fourteen strategic aims for the decade 1994 to 2003. One of these strategic aims concerned educational technology:

> 'To operate at the forefront of educational and technological developments relevant to large scale, distance education.'

To ensure that this strategic aim was achieved the Open University adopted the methodology of performance measurement (Eccles, 199 1; Burt, 1995). According

to this methodology the organization must identify the performance which would constitute the achievement of the aim, select some 'indicator' of the desired performance, continuously take measurements of this indicator and if necessary take remedial action when targets are not being met. For the particular strategic aim just quoted, two performance indicators were adopted. One performance indicator concerned the use of computing. The other performance indicator concerned the use and helpfulness of course components:

> 'Improved use and helpfulness ratings of course components as revealed in annual surveys of students.'

In the annual surveys referred to, students rate each course component on whether or not they used the component and if so how much of it they used. For example, some students may have read all of the set book whereas other students may have had time only to read part of it. Some students may have gone to all the tutorials while others may have gone to a few or none. Students are also asked to say how helpful they found each component for their study of the course. For example the teaching text might be more or less helpful according to how well the ideas have been explained. The survey leaves it up to the student how they intrepret 'use' and 'helpfulness' -for example does the question mean 'helpful for learning and understanding' or 'helpful in passing the exam'?

This seems fair enough, but what would count as 'improved use and helpfulness ratings'? One view might be that the greater use of components is a good thing. For students are likely to get the best out of an integrated system only if they make full use of the components which are meant to be integrated. Also it may sound implausible to claim to be at the forefront oftechnological developments if students are not using the technological components. However this is only half the story. An alternative view is that greater use is not necessarily a good thing. For instance it is always possible for the institution to increase the use of a component simply by making it compulsory. However doing this may force certain students to use a component which does not help them or for which they need to pay some extra cost. According to this second view then, institutional control may prevent students exercising choice and using the components in the way best suited to their own individual needs.

What is involved here is the balance between institutional control and student freedom of choice. Institutional control is expressed in the components in a variety of forms: satisfactory completion of the assignments is required in order to pass the course; the summer school component is compulsory; all course components are designed to have varying degrees of integration with other course components; and the design of each component is such that it offers the student some kind of reward schedule. On the other hand students usually have a certain degree of freedom of choice in their use of components, particularly those components which have an ancillary role.

The rationale for greater institutional control is that the institution has the necessary knowledge and expertise to design the student experience in such a way

as to optimize the students' learning. Indeed much (but not all) educational design research is intended to discover the design principles which can provide the foundations for such expertise. The rationale for student choice is that it is the student who knows their own self-interest best, that the institution does not have that knowledge and even if it did variation between students would obstruct the design of a system which would be ideal for all. For students have different needs and preferences and a variety of components should be offered so that these individual differences in student needs can be catered for. (See Burt 1996a for discussion and evidence on whether the student knows best in the context of their decision to continue study; and Burt 1996b for a discussion of the social choice issues involved when students' needs differ). The emphasis in this second view, then, is on open and flexible learning. The contrast between these two views is encapsulated by the following two questions:

> To what extent does institutional control over the use of components force students to do components which are less helpful?
> How varied are the individual differences which need to be catered for?

The aim of the present paper is to answer these two questions by analysing the use and helpfulness ratings for the course components of a second year course at the British Open University. The present study shares certain features with other recent investigations. Saga (1995) reports on the use and importance of instructional components as perceived by students at the Allama Iqbal Open University in Pakistan (the main concern of the study is however the students' attributions of learning from the media). Valcke (1995) reports on a multivariate analysis of the use of components of a multimedia system. Factors were identified yielding a clustering of components according to their design function. However it is von Prummer's (1995) study of the Fernuniversitat in Germany which most closely shares the concerns of the present paper: she notes the relationship between media provision and issues of equity or openness; she notes the distinction between usage and helpfulness ('use' and 'preferences' in her terms); and she notes that:

> The actual communication patterns of distance education students are the outcome of various interacting factors such as: personal likes and dislikes, abilities and disabilities; access to different types of communication, cost of using it and time needed; and institutional requirements and provisions. (p. 294).

In this study 'personal likes and dislikes' are included in the more general concept of 'tastes'; access, cost and time variables are seen as influencing a person's predisposition towards the use of a particular medium; and institutional requirements and provisions are addressed using the concept of institutional control and the concept of the designed integration of components.

The course and the questionnaire

The results to be reported in the present paper concern a second year course at the British Open University. The components of the course include Tutor Marked Assignments (TMAs), Computer Marked Assignments (CMAs), the main course text, the summer school, the video, the audio, the television, the video notes, the audio notes, the television notes, the study guide (one for each of the three blocks of the course), the course guide, other notes (including the summer school notes) and the tutorials. This set of components is rather typical of what Burt (1996c) has referred to as a first generation multimedia system (adapting a distinction made by Bates, 199 1). He notes that the components in a multimedia system form a coherent structure and suggests that, in 'first generation' multimedia systems the structure of components is such that the text is still the dominant medium even though a variety of other media are also used. In contrast in 'second generation' multimedia systems a computer environment supports the learner and it is the computer which is the lynchpin in the structure of components.

Burt (1996c) suggest that one of the key features of a media component is its educational function or role in the multimedia system. Looking at the Course Guide for the course we are studying here, he analyses the advice in it in order to establish how the components fit together. The discussion in the Course Guide implies a mutual understanding between the course team and the students that study is to a large extent assessment-driven although the course team is at the same time anxious to broaden the students' approach to study. The Course Guide also indicates that text is dominant. Other media are related to the text in different ways and to varying degrees. The advice on the use of other media recognizes the centrality of the assessment and of the text. Supporting the use of these media are various guides. Also in a supporting role are the tutorials arranged by the Open University regions (the regions have different geographies and this creates a need for variation of treatment). Finally the course provides a summer school which is compulsory. In summary the structure of components here is as follows. The goal is to gain a course credit. This is achieved by satisfying the *compulsory* summer school attendance and by achieving the goal of passing the *assessment. Theprimary* teaching components provide the knowledge and skills required for this and they are supported in this by *secondary* teaching components, themselves supported by *guidance* notes.

At the end of the course a sample of 353 students completed a questionnaire which included questions about the use and helpfulness of the course components. Of these 254 students replied, a response rate of 72%. (These respondents are likely to be students who have somewhat better course performance than non-respondent students). They were asked whether they had used all or most or some or none of each component. They were also asked to rate each component as very or fairly or not very or not at all helpful for their study of the course (Student Research Centre, 1994).

Data Analysis

Each of the following sections provides evidence regarding the effects of institutional control and of individual differences. The first section presents data on use and helpfulness for the group of students as a whole. Thereafter the evidence deals with individual differences, firstly considering each component separately and then considering correlations between components. Correlations between the use of components, correlations between the helpfulness of components and, finally, correlations between the use and the helpfulness of components are studied in turn. At the start of each section a brief overview of the key points is given.

Use and helpfulness: the group response

This section is concerned with the response of the group of students as a whole. The group's use of course components is shown to depend on the balance between institutional control and student choice. Some course components are designed by the institution to be necessary. For these components, use levels are high and helpfulness is high but varied. Other course components are designed to be ancillary. For these components, use levels are low and varied but helpfulness remains at a constant low level. Thus if there is strong institutional control it may happen that students will be forced to use a component which they find less helpful. In contrast if students are given control they adjust their level of use in order to maintain a certain level of helpfulness.

Table 1 : Use and helpfulness of different components.
Use: percentage of students using all/most of the component
Helpfulness mean: 1 very; 2 fairly; 3 not very; 4 not at all

Component	Function	use	helpfulness
Computer Marked Assignments	assessment	99	1.85*
Tutor Marked Assignments	assessment	96	1.56*
Tutor Marked Assignments	assessment	96	1.76**
main course text	primary	95	1.47
summer school	compulsory	95	1.94
videocassettes	primary	89	1.68
audiocassettes	primary	80	2.02
course guide	guidance	79	2.13
other printed material, e.g. summer school notes	guidance	76	2.06
study guide	guidance	75	2.14
audiocassette notes	guidance	67	2.01
videocassette notes	guidance	66	1.99
TV programmes (as broadcast or recorded)	secondary	59	2.07
TV notes	guidance	54	2.14
tutorials	secondary	40	2.13

* The rating is for the helpfulness of the assignment in consolidating learning.
** The rating is for the helpfulness of the tutor's comments on the assignment.

Table 1 lists the course components and specifies their function in this particular course. It then presents indices of use and helpfulness for the group of students as a whole. The index of use is the percentage of students who used all or most of the component. The index of helpfulness is the mean helpfulness rating for each component. The mean is calculated designating very helpful as 1, fairly helpful as 2, not very helpful as 3 and not at all helpful as 4.

Components which have assessment or primary teaching functions or are compulsory are more used and more helpful than components which have a guidance function or a secondary teaching function. So the components which have greater use are also rated as more helpful. However this relationship takes a particular form. For the primary or assessment or compulsory course components, the use and helpfulness levels are both high. Whereas the high use levels vary little, being compressed in the range 90 to 100%, the high helpfulness means vary a great deal, ranging over half a scale point. For the guidance or secondary course components, the use and helpfulness levels are both low. Whereas the low use levels vary a lot, ranging from 40% to 80% use, the low helpfulness means vary little, all very close to 2 corresponding to a rating of fairly helpful. High use may be due to strong institutional control. If this is the case it may happen that students will be forced to use a component which they find less helpful-the summer school is a clear example of this. In contrast if students are given control -as is the case for guidance components and secondary teaching – they adjust their level of use in order to maintain a certain level of helpfulness. So where there is choice, those who feel that a component would be unhelpful can choose not to use it.

Individual differences in use and helpfulness: each component separately

This section looks at individual differences in response, taking each component separately. An earlier study (Student Research Centre, 1995) indicated that the course components are designed by the institution to have a certain reward schedule. Most students made sufficient use of any given component to satisfy the minimum reward threshold for that component. Individual differences between students in the use of the component occurred primarily at levels of use above the threshold level. Turning to differences between students in their helpfulness ratings, the components which exhibit greater variation between students are those components where there is variation of provision by the institution.

The previous section has reported on the use and helpfulness of the components for the group as a whole. However not all students give the same rating. Table 2 gives the standard deviation of the helpfulness ratings for each component. The magnitudes of the standard deviations are roughly between half a rating point and a whole rating point (between 0.5 and 1.0). Most components have a standard deviation of around 0.7. The text has a slightly lower standard deviation but that is probably an artifact: the high mean rating constrains the distribution of ratings to be mainly at the top end of the scale. The highest standard deviations indicate a more substantive point. For these are to be found for the following components: the tutor's comments on Tutor Marked Assignments, the summer school, the tutorials and the

television programmes. One possible explanation of the higher level of standard deviation in these four cases is that it reflects variability in provision by the institution. Whereas students experience the same text and the same videocassette they experience different summer school tutors and different course tutors. There may be a similar explanation for the higher standard deviation of the television. Here too there may be variability of provision in the sense that many students may watch the television when it is broadcast even though the students are at different stages of their study. If the television has been designed for a particular stage of study then it may be too early for some students and too late for others. (Of course these comments do not apply to the group of students who pre-record the television for later use).

Table 2: Differences between students in their helpfulness ratings: the standard deviations in the ratings for each component.

text	v c	VCn	CG	TMAc	
.57	.68	.69	.69	.69	
TV	SG	other	A C	ACn	CMAc
.70	.71	.71	.74	.74	.78
TMAt	TVn	s s	tutorials		
.86	.88	.90	.91		

Key:
TMA: Tutor Marked Assignments; CMA: Computer Marked Assignements; VC: videocassette; AC: audiocassette; TV: television; SG: study guide; CG: course guide; SS: summer school; n: notes; c: consolidation of learning; t: tutor comments,

'Individual differences: correlations'

In the previous section we considered variation in the use and helpfulness of each component separately. We shal I now look at how the use or helpfulness of one component relates to the use or helpfulness of another component. We shall do this for each pair of components, in this way investigating the multivariate variation in the use and helpfulness of components. In this section we present a discussion of the implications of finding correlations of different magnitudes. We refer in this discussion to helpfulness, but similar remarks apply to use.

The key question here is: if a student finds component A very helpful, does that same student also find component B very helpful. Roughly speaking there are three possible answers to this question:

(a) Yes, students tend either to find both A and B very helpful, or to find both A and B not very helpful. This situation is represented statistically by a positive correlation.

(b) Quite the contrary to (a), if students tend to find A very helpful then they find B not very helpful, and vice-versa. This situation is represented statistically by a negative correlation.

(c) Neither A nor B: whether students find A very helpful or not is unrelated to whether students find B very helpful or not. This situation is represented statistically by a zero correlation.

Under what circumstances might we obtain each of these answers? If each component has its own special characteristics (as some media specialists argue) then the helpfulness of a component will depend on these special characteristics. This might suggest that the correlations between components would be zero. Alternatively there are also reasons for supposing that positive correlations might be found. There are two main ways in which this might happen. Firstly if the multimedia system is designed to be integrated then the students will only benefit if they study the components in association with one another. We shall refer to this as 'correlation due to integration'. However a correlation might still arise even in circumstance where there is no integration between components. There may instead be a common 'taste' factor which if present encourages the student to use both components. In this case the components are related indirectly: they both share the same taste factor. We shall refer to this as 'correlation due to taste'.

Whereas we shall refer to taste in the context of correlations between helpfulness ratings, we shall refer to 'predisposition' in the case of correlations between use ratings. The distinction between predisposition and taste can be explained as follows. A student may have a predisposition towards the use of the tutorials because he or she lives close to the study centre and his or her work and leisure activities fit in well with the schedule for the tutorials. However these factors do not imply that the student has a taste for tutorials as a teaching device-they do not imply that the student will rate tutorials as very helpful. On the other hand if the student has a taste for tutorials then that taste also contributes to a predisposition for tutorials.

Individual differences: use correlations and helpfulness correlations

An earlier study (Student Research Centre, 1995) investigated the correlations between the use of one component and the use of other components. Clusters of components were identified. Within each cluster there was a tendency for students either to make a lot of use of all the components in the cluster or for them to make little use of all the components in the cluster. The membership of some clusters appeared to correspond to the functional integration of components which had been designed by the institution. The membership of other clusters appeared to correspond to the differential predispositions of the students towards specific types of components. A corresponding analysis will now be carried out on the correlations between the helpfulness of one component and the helpfulness of other components. Clusters were identified here too, some but not all corresponding to the use clusters

identified in the earlier study. Here too clusters appear to correspond either to functional integration of the components or to the differential 'tastes' of the students for specific kinds of components. The general conclusion is that clustering occurs as a result of institutional design and student predisposition and taste. The presence of many clusters and the presence of several 'uncorrelated' components indicate that predisposition and taste have many dimensions.

The set of correlations between all the pairs of components in terms of helpfulness ratings can be displayed as a correlation matrix. The correlation matrix is displayed in two parts in Table 3. One approach to analysing the correlation matrix would be to establish which correlations were statistically significant. In fact with a sample size of 254 students even very low correlations of 0.15 are significant at the 95% level. By this criterion most of the correlations in the matrix are significant. However this is not what is most interesting about the correlation matrix. Here the main interest is to identify clusters of high correlations. (A good analogy here is with a map of the physical features of a country. What is of prime interest is the distinction between the highland regions and the lowland regions.) To do this I adopt a somewhat arbitrary definition of high and low (just as a physical map does). I shall consider a correlation of 0.4 or above as high and a correlation of below 0.4 as low.

From the first part of the correlation matrix it would appear that situation (c) obtains. Correlations between components are low. This suggests that the text, the Tutor Marked Assignment, the Computer Marked Assignment, the summer school the tutorial and the videocassette each have quite specific characteristics and it is these specific characteristics which affect students' helpfulness ratings rather than any common characteristic. So for these components tastes are specific, associated with just one type of component. (However the earlier study did find some common predispositions amongst these components, Student Research Centre 1995).

The second part of the correlation matrix provides a different answer. Here it would appear that situation (a) frequently obtains. The highest correlation is between the course guide and the study guide, constituting a cluster of 'strategic guides' (a taste correlation, r=0.78). Next the correlation between audio notes and video notes constitutes a cluster of 'cassette notes' (a taste correlation, r=0.77). Next there is the set of media guides, now including the television notes (the median of the correlations is r=0.68, a taste correlation). The correlation between the audiocassette and the corresponding audiocassette notes constitutes an audio cluster (r=0.67, an integration correlation). The cassette components, both video and audio, and also programme and notes come next (median r=0.56, a taste correlation). The cluster of 'guides for the current block of material' includes the media guides and the study guides, but not the course guide (median r=0.54, an integration correlation). Median correlations of 0.48 are obtained for the following clusters of components: the media components, that is including the video, the audio and the television, and also the programmes and the notes; the media programmes, the visual components, both video and television, and also programmes and notes; and the videocassette components, both programme and notes. Median correlations of 0.47,0.46,0.44 and 0.43 are obtained respectively for: the television components,

both programmes and notes; the entire set of guidance notes; the non-media guidance notes; and the summer school, both the school itself and the notes. These later clusters are a mixture of taste and integration clusters.

Table 3: Correlations between the helpfulness of the components

	text	TMA	CMA	SS	VC	AC	other compts.
Text	01	*30*	*36*	*22*	*16*	*23*	**
TMA		01	20	14	11	26	*
CMA			01	21	13	31	*
Summer School				01	08	13	* (*43* SSn)
Videocassette					01	55	see below
Audiocassette						01	see below

	VC	AC	TV	VCn	ACn	TVn	SG	CG	SSn	tut
vc	01	55	48	48	***	***	*	*	**	*
AC		01	*29*	*57*	*67*	***	*40*	***	***	*
TV			01	**	*	*47*	*	*	*	**
VC notes				01	77	68	52	42	***	*
AC notes					01	52	52	46	***	*
TV notes						01	55	***	***	*
Study Guide							01	78	44	*
Course Guide								01	***	*
SS notes									01	*
tutorial										01

Notes:
(i) *, ** ,*** denote low correlations of -0.10 to +0.19, 0.2 to 0.29 and 0.3 to 0.39 respectively.
(ii) TMA: Tutor Marked Assignments; CMA: Computer Marked Assignments; VC: videocassette; AC: audiocassette; TV: television; SG: study guide; CG: course guide; SS: summer school; n: notes; c: consolidation of learning; t: tutor comments.

How the student's use of component relates to its helpfulness

An earlier section studied the group of students as a whole and found that components which were used a lot were also the components which were rated more helpful. That group result depended on comparing different components. Here we take each component separately and study differences between students: if a student uses the component a lot do they also tend to find it more helpful? The relationship is shown to depend on the balance between institutional control and student control.

Some course components are designed by the institution to be necessary. For these components, use levels are only weakly related to helpfulness. Other course components are designed to be ancillary. For these components, use levels are strongly related to helpfulness. As before if there is strong institutional control it may happen that individual students will be forced to use a component which they find less helpful. In contrast if individual students are given control they individually adjust their level of use in order to maintain a certain level of helpfulness.

Table 4 below presents the results. There are high correlations between usage and helpfulness for each of the audiovisual components and also for the tutorial. Somewhat lower are the correlations for the study guide, the summer school notes and the course guide. The correlation for the text is lower still. Usage and helpfulness are virtually uncorrelated for the Tutor Marked Assignment and the Computer Marked Assignment.

The most natural way of interpreting the high correlations between usage and helpfulness is to say that the student decides whether or not to continue using a component on the basis of how helpful the component has proved so far. Students who have found the component helpful continue to use it. Students who have not found the component helpful stop using it. Where there are low correlations the decision to continue using the component must be made on some other basis. For example assignments are used in order to pass the course, and texts are used because they are necessary for the assignments.

Table 4: Correlations between the level of use and the helpfulness for each component separately.

text	TMA	CMA	SS		
31	08	24	-		
VC	AC	TV	VCn	ACn	TVn
61	60	61	56	56	55
SG	CG	SSn	tutorial		
50	42	49	59		

Key:
TMA: Tutor Marked Assignments; CMA: Computer Marked Assignments; VC: videocassette; AC: audiocassette; TV: television; SG: study guide; CG: course guide; SS: summer school; n: notes; c: consolidation of learning; t: tutor comments

An alternative interpretation of the high correlations would be that the more a student used a component the more he or she got out of it, that is the more helpful it was found to be. This effect seems particularly plausible in the case of guidance notes, although even here it might be judged that the effect postulated in the previous paragraph would be more powerful. (Another alternative explanation is that the effect is due to cognitive dissonance).

How use and helpfulness interact across components

The previous section shows how individual students adjust their use of a component depending on how helpful they find it. In this section it is tentatively suggested that students who find a particular component helpful may be encouraged to use certain other components.

In the previous section the correlations between the use of a component and the helpfulness of that same component was investigated. Now the correlation is investigated between the use of one component and the helpfulness of a different component. Usually such correlations were low, below 0.4. However there were a few high correlations involving the audiovisual components and the guidance notes. These correlations are presented in Table 5. For example, the entry of 44 next to the top left comer indicates that the use of the videocassette has a correlation of 0.44 with the helpfulness of the audiocassette. Notice that the entries in the main diagonal are the same-component use-helpfulness correlations presented in the previous section.

As in the previous section a high use-helpfulness correlation can be interpreted in two ways. Firstly if one component is helpful then that may encourage the student to use another component. This is a possible explanation of the correlations between the helpfulness of the programme notes and the use of the corresponding programmes (see the bold diagonal: 46, 47, 42). The correlations between the helpfulness of the audiocassette and the use of the videocassette and vice versa and the correlations between the helpfulness and the use of guidance notes for different programmes may also indicate that the helpfulness of one component fosters the use of similar components. (This may also explain the correlations between the helpfulness of the study guide and the use of the guidance notes, although here the explanation appears less plausible).

The second interpretation of a high correlation is that if one component is used then that may render another component more helpful. For example the correlation of 0.44 suggests that the use of the audiocassette notes renders the audiocassette more helpful (note that this effect is at best weak for the videocassette and the television).

Conclusion

In the introduction it was reported that use and helpfulness of course components had been selected by the British Open University as key performance indicators. The question was raised as to whether or not greater use of components was a good thing. It was suggested that in order to answer this question evidence was required concerning the effects of institutional control over student use of components and concerning individual differences in student needs.

Table 5: Correlations between the use and helpfulness of different components.

	VC	AC	TV	VCn	ACn	TVn	SC	CG
Use:								
v c	61	44	***	46	***	***	**	*
AC	43	60	**	47	47	***	**	*
TV	**	**	61	**	*	42	*	*
VCn	***	40	*	56	45	48	40	**
ACn	**	44	*	58	56	49	45	***
TVn	**	**	***	49	***	55	40	**
SG	*	**	*	***	***	***	50	***
CG	*	**	*	**	***	**	45	42

Key:
VC: videocassette; AC: audiocassette; TV: television; SG: study guide; CG: course guide; n: notes.

The subsequent sections have provided the required evidence. Different forms of institutional control have been shown to affect the use and helpfulness of components. The statistics for the group of students as a whole provided evidence that if there is strong institutional control then it may happen that students will be forced to use a component which they find less helpful. In contrast if students are given control they adjust their level of use in order to maintain a certain level of helpfulness. This latter point is also indicated by the correlation between the use of a component and the helpfulness of that same component. Such correlations were high for components over which the student had greater freedom of choice. The correlation statistics exhibit clusters some of which were interpreted as being due to integration in the design of the components. In all these ways then, institutional control had an influence on use and helpfulness.

Other results also demonstrate the influence of institutional control. For each component the range of variation in levels of use depends on the reward schedule, in some cases exhibiting a threshold level. There is also evidence of variation in the institutional provision of certain components, with students experiencing different course tutors and different tutors at summer school, and with the fixed delivery schedule of television programmes having a differential impact on students operating different study schedules.

The results mentioned in the preceding paragraph concerned differences between students in the use and helpfulness of each component separately. Individual differences have also been studied via correlation clusters. Correlation clusters were interpreted in terms of the designed integration of the course

components, and the individual differences between students in predisposition and taste towards different kinds of components.

Within a single correlation cluster, there is a tendency for students to vary along a single dimension, namely the overall level of use or helpfulness of the components in the cluster. However the study has identified a variety of different clusters. This points to multidimensional variation of student predisposition and taste-over many dimensions. In addition to the clusters, components which do not have high correlations with any other components constitute extra dimensions on their own.This increases the number of dimensions even further.

This fact provides the answer to the second question of how varied are the individual differences which need to be catered for. The fact that predispositions and tastes exhibit a great variety of dimensions implies that the institution needs to provide a wide range of components if it is to meet these widely varying needs. When such a range of components is provided, students will adjust their level of use of the components to suit their varied predispositions and tastes. So attempts to use institutional controls to boost use in accordance with the performance indicators may force students to use components which are not helpful. This conclusion is relevant not just to the British Open University but also to other institutions which provide a similar mix of components. Indeed the use and helpfulness ofcomponents are key performance features of any multimedia system, and so the arguments of this paper are of general relevance.

The present study possess a number of limitations. The evidence here derives from just one source, the responses to a single questionnaire. As with any survey, respondents are likely to be somewhat atypical of the whole population. There is a need to validate the responses against some other data source. Also the evidence refers to just one course in just one institution. To what extent would evidence about other courses and other institutions produce similar results? There are also a couple of methodological issues which need further exploration. To what extent does the nature of the rating scale distort the various statistics? Assuming the statistics are robust, what scope is there for analysing the statistics using a more sophisticated method such as hierarchical cluster analysis, factor analysis or structural equation models (Murtagh and Haeck 1987; Cattell 1978; Goldberger and Duncan 1973). A major project is now under way to remedy some of these deficiencies. This will involve the analysis of forty-five courses across the full range of academic disciplines and substantial enhancements in statistical sophistication are planned (Simpson, Young & Burt, 1996). One important issue which a wider study might usefully address is whether or not the results reported in the present study are artefactual: perhaps what is important is not the medium itself or even its functional role in the system – perhaps what is really important is the quality of design of a media component. This latter hypothesis is akin to some of the arguments advanced by Clark (1994) and it might be given some credence if it proves impossible to reproduce the pattern of correlations reported here for this one course.

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