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The Development of a Systems Analysis Approach to Small-scale Educational Evaluation

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ABSTRACT *The adaptation and application of a systems analysis model devised for educational evaluation is discussed in the context of educational evaluation of a small specialist centre and the benefits of the adaptation explained. The ways in which the adapted model was used to gain a realistic picture of the centre are outlined and the potential usefulness of the framework discussed.*

Introduction

The current emphasis on demonstrating effectiveness in public services has complex implications for all those engaged in educational practice. Over the last decade in the UK there has been a move to teach towards nationally agreed curriculum targets and to measure children's individual attainment of these targets. Such information has been used in aggregate to rank schools' performance and to construct league tables of the relative 'success' of schools in delivering educational attainments. Such approaches are fraught with difficulties when applied to mainstream schools and, despite the commitment of special needs educators to the UK national curriculum, are more unsatisfactory when applied to schools providing specialist teaching to children with special educational needs. Indeed, the presence of such children and schools' proper attempts to meet their needs are cited as factors which can influence a school's placement in an educational 'league', reflecting some inevitable differences in such children's educational attainment (Roberts, 1997). Special educators may find that many of the more formal evaluative techniques used to measure good schooling are inappropriate for their purposes.

Nonetheless, the search for 'evidence-based' schools evaluation is challenging practitioners. Special educators, as other professionals, are concerned to reflect upon practice and to evaluate their work on a day-to-day basis. They find themselves familiar with the concept of ongoing evaluation and, indeed, special education has a long history of measuring 'outcomes' of education in respect of children's attainment of individual goals as set out in their Individual Education Plans (Cooper, 1996). However, there remains a need to define appropriate methods of evaluating the totality of special educational practice in real life contexts. Unlike some evaluation in medical and health service contexts (McCartney & van der Gaag, 1996), approaches to evaluating success in an educational context have been concerned with

a holistic picture of schools and their effects on children's lives (Norwich, 1996). This paper outlines a worked example, taken from applied systems approaches, of the development and application of a framework for evaluating small-scale educational establishments for children with special educational needs.

The Research Example and Evaluative Approaches to Educational Research

The framework arose out of a 3 year evaluation of a new Scottish national centre using the principles of conductive education, the Scottish Centre for Motor Impairment (the Craighalbert Centre) (MacKay *et al.*, 1996). The Centre was set up to cater for the needs of families with physically disabled children who wanted their children to experience conductive education without having to travel to the Peto Institute in Budapest, where such education was otherwise available (Hari & Akos, 1988). Conductive education was, however, to be delivered along with the best Scottish educational practice. The Centre was dealing with many pre-school and developmentally young children where the school curriculum had limited application; it had a residential option, but also took children who travelled on a daily basis from a number of education authorities, and was using educational principles and practices which had not been carefully expressed in a UK context (Bairstow *et al.*, 1993).

Nor was the research concerned only with outcome measures: it was charged with evaluating the Centre's place within the Scottish educational context. This raised the need for practitioners of conductive education to specify the circumstances in which it was the appropriate pedagogy for achieving certain educational aims; at the time such issues had rarely been addressed (Lambert, 1992). The challenge for the research project was to set the interpretation of conducting as practised at Craighalbert firmly in terms of the systems of the Centre and, beyond that, in the whole national scene. In those terms questions such as 'does conducting work?' and 'is it better than other methods?' did not arise. They were to be replaced by others such as 'how and when is it used?' and 'to what extent does it assist the delivery of effective teaching and learning?'.

The complexity of the questions raised by the evaluation of Craighalbert made it clear that a different philosophy of research was required from the classical experimental designs that were used in the study of the somewhat comparable Birmingham Institute (Bairstow *et al.*, 1993), which adopted Hungarian conductive practice in a more direct manner. Instead, there was a need for the more flexible, interactive and responsive approaches that, in British education, have their roots in the work of Stenhouse and his followers (from Stenhouse, 1975, onwards). The contrast in outlook is discussed well by Milne (1987), who distinguishes what he calls an 'evaluative format' from the traditional classical approaches which he calls 'basic research'. However, undertaking Milne's 'evaluative' type of study creates difficulties of its own. The enquiry must be responsive to the circumstances to which it is applied, but it must also be systematic. The solution implemented in the Craighalbert evaluation was a systems approach to the evaluation of educational systems that had been proposed by a Hungarian social scientist, Béla Banathy (1973, 1992, 1996; see also MacKay *et al.*, 1993a, 1995).

The Systems Approach in the Craighalbert Evaluation

Banathy's model was chosen because of its firm location in educational settings. He uses helpful visual imagery of 'birds eye', 'moving picture' and 'still picture' to

describe the three main 'models' of his system. During the course of the research project these models were developed in ways which will be described, but an outline follows to explain the starting point and the main features of the system. The selection of the three level model and the subsequent systems analysis fitted the Centre as a purposive systems type and the consultant-driven systems designs operating in setting up the research programme (see Banathy, 1996, p. 271).

Banathy's Three Level Model

The 'Bird's Eye Model': 'systems environment'

The systems environment model allows researchers to describe a school, service or other form of provision in the context of its community and of the larger society. Banathy (1992, 1996) sees it as a lens through which to have a bird's eye view of the landscape in which the system is sited. In that context researchers are likely to be interested in questions that examine how the system being studied and the individuals and other systems with which it comes into contact relate, interact and are interdependent. This outlook encourages questions about how adequately the service being studied responds to the context in which it is set and, conversely, about how responsive that context is to the service which is on offer. In the case of a school the relation between it and the education authorities and the relationship between it and the families of its pupils are areas of enquiry to which the systems environment outlook is particularly appropriate.

The 'Moving Picture Model': 'process'

This model helps to direct enquiry at what a system does across a period of time and thus is concerned with the process of people's engagement with the system. Typically it is concerned with:

- input to the system (such as a pupil's enrolment in a school or referral to a special service);
- transformation operations through which the input states of individuals undergo change;
- output processes by which people move on from the system being studied;
- feedback and adjustment concerned with interpreting and developing the system.

The process approach may be used, simply, to chart an individual's contact with a service, along the path of referral, admission, provision, review and, eventually, transfer, though of course this list could be extended. Such charting may be useful for generating questions about the whole system or about parts of it, perhaps by techniques such as critical incident analysis. Such an analysis may yield guidance on the more effective operation of the system, either by direct action or by more gradual development of staff or procedures. The overall aim is to achieve this by an understanding of the system as an active entity, hence the 'moving picture' analogy.

The 'Still Picture Model': 'functions/structure'

The 'functions/structure model' is concerned with features of a system such as its goals, the functions it carries out to meet these goals, the various components of the

functions and the organisation of functions and components. [This is a development of the 'general still picture model' of schooling described in Banathy (1973), which is based on the principle that systems exist for the purpose of achieving goals.] The purpose of his functions/structures approach is to take metaphorical snapshots of these aspects, so that they may act as points of reference against which to examine past and future practice.

Functions are 'behaviours that can be observed' in the system. They include all aspects of input and output in the school affecting pupils, staff and others with reference to growth, feedback, control, accommodation and so on. Thus practical examples of functions would include class teaching, learning support, timetabling, in-service education and maintenance of equipment. Banathy sees the key general function being the transformation of input into output. Goals are related intrinsically to functions, in that the analysis of goals leads to the identification of functions that the system (here the school) has to carry out in order to achieve its goals.

Investigation of the functions of the school will reveal who and what are required to carry out these functions. This is likely to lead, first, to the specification of a set of subsystems 'such as administration, instruction, facilitation and maintenance' (Banathy, 1973, pp. 28–29). His 'components' are the substance of these subsystems and include human and material resources. The components of the instructional subsystem include pupils, teachers, classrooms, books and other materials, interconnected by a set of relationships. Similarly, administration and the other subsystems have their own sets of patterned relationships. Banathy considered that the more the subsystems are segregated, the more likely is the degeneration of the system as a whole. Consequently, the integration of subsystems, by communication among them, has a special place in enabling the system to meet its goals.

Beyond the 'Functions/Structure Model'

The evaluation of the Craighalbert centre led us to develop the third of Banathy's components, the 'function/structures' model. Banathy regards goals, functions and components as being bound together in a single model, the 'still picture', which describes how systems are at a given moment. However, in his later writing Banathy (1992, 1996) draws more attention to the relational arrangements within and among components, by calling them 'structures' and by changing the name of the 'still picture model' to the 'functions/structures model'. Here, we wish to suggest that there may be value in extending the model again, by separating functions and structures. In part this development is suggested for pragmatic reasons: we have found that it provides a clearer context within which to ask different types of questions for different types of purpose. In part it also hints at discontent with Banathy's assertion that 'the goal-functions-component sequence is obligatory' (Banathy, 1973, pp. 23). Perhaps it may be ideal, but it cannot be obligatory, for such an assertion is based on the assumption that educational planning is a rational process of planning and implementation from a fresh start. In practice, all sorts of 'components' and the structures that link them are likely to exist, in the form of people, materials, attitudes, expectations and time (to name but a few), even before the goals are set. This is related to the fact that the research comprised a systems *evaluation* approach, rather than a systems *design* approach.

For these reasons, in the Craighalbert evaluation we began to examine a dimension that describes how the goals of a service are achieved. This dimension has two major

poles of focus: the functions, or the means by which goals are achieved; the structures, which concern the internal organisation of these functions and the relationships among and between them. The following examples may help. The function of increasing a staff's understanding of collaborative working may be effected by structures such as team meetings and courses. The function of parental empowerment may be effected by attention to the development of structures such as parents' groups and explicit lines of communication.

The evaluation of the Scottish Centre for Motor impairment therefore adapted Banathy's models a little and used the four dimensions of *functions*, *structures*, *process* and *systems environment* for guidance in the formulation of questions and the development of instruments to answer them. These dimensions proved very useful in giving structure to the large and diverse amount of evidence collected as part of the evaluation project and in tracing a path through complexity. The ways in which the model aided the development of measurement instruments and the structuring of data will be outlined and presented as illustrations of the process.

Application of the Quadrant Systems Model

Using a systems approach means that methodologies may have to be created for that system alone, in the absence of satisfactory off-the-shelf techniques. Banathy argues that a consideration of functions is a logically necessary first step in systems evaluation, but as stated, many organisational features are set up early, even in a new centre, to fit in with established patterns of provisions and the expectations of service providers and users. For these reasons, our discrete category of structures and the methods used to evaluate them are discussed separately, and first.

The Structures Model

Structure measures describe the decision making procedures and the formalised ways in which each part of a service relates to other parts, including the structured ways in which opinion is sought by the service. They also deal with relatively consistent aspects of the school context, such as the school year and the timetable, and relatively permanent features of classroom organisation, such as how children are grouped. These can be gauged by analysis of formal documentation (such as mission statements and school plans) and by dialogue with policy makers (from the management team and the Board of Governors) and providers of the service (the staff). The Craighalbert research devised iterative interview schedules for such people, giving information on topics such as: the types of children it was felt Craighalbert could serve most effectively; mechanisms for liaison with parents, education authorities, health boards and other agencies; the staffing structure of the school; classroom organisation and the means of organising transition between the school and other local services such as mainstream school.

The Functions Model

This method of understanding a system is concerned with describing the goals of the system and the functions it carries out to meet these goals. Perhaps the first step is to consider what the service intends to provide and how it intends to do so. Data from document inspection and staff interviews were again used to elucidate function

measures. These provided information on topics such as the practicalities of collaboration with parents and the extent to which there was seen to be a role for conducting as a distinct profession. Details of the curriculum offered were also gained in this way and by observing in class.

A major function of any educational establishment is the progress of the children and two sets of measures were taken to establish this. One involved goal attainment scaling, which measured children's progress towards educational targets; details of procedures appear in MacKay *et al.* (1993b). Curriculum attainment targets and/or outcome measures from individual programme plans would of course be relevant here.

The other main measures of progress comprised a battery of standardised assessments to establish how the children progressed compared with normal children. The assessment battery was carried out within the children's homes at annual intervals. It was felt that the tests chosen should assess children's ability to function in various areas, in accord with the philosophy of conducting. The selection of tests must be matched, of course, to the range of children who attend any particular establishment. As a result of this preliminary work on assessment it was decided to use only those instruments which required direct observation of the child in natural settings, with supplementary information being provided by parental report. More formal tests, requiring children to 'perform', were rejected after trials for several reasons: they did not cover a sufficiently wide range of abilities and attainment at the most modest levels often relied on physical, particularly manual, dexterity.

In the end it seemed appropriate to consider measures of:

- *global development*; using the National Children's Bureau *Development Guide* (National Children's Bureau, 1977);
- *functional motor development*; using the Detroit Orthopaedic Clinic coding of function in cerebral palsy (Anderson, 1966) and the staff completed the *Movement Assessment Battery for Children* (ABC) (Henderson & Sugden, 1992);
- *functional communication*; using the Dewart & Summers *Pragmatic Profile of Early Communication Skills* (Dewart & Summers, 1988);
- *responsiveness to teaching*; using Stott's (1978) assessment of a child's learning skills, completed by staff.

These assessments met the requirements of providing information on global development, functional motor development and functional communication.

Each of these measures has some degree of difficulty in being applied to young children with varying amounts of disability, but low key monitoring of this type over time provided a helpful norm-based or criterion-referenced sketch of the children as they grew, even though it offered limited opportunity for sophisticated statistical analysis. Systems approaches are sufficiently flexible to allow schools to adopt their own system of regular review assessments.

The Process Model

A process model focuses inquiry on how the system behaves. In the context of a service such as Craighalbert it was used to understand how that service affects the lives of the people within it: children, families, staff and others.

The model is based on the assumption that the contact of every child with the educational establishment follows a series of events. The start of this series is the

child's referral; the end point is the completion of transition to educational provision in her or his home area, and perhaps aspects of the child's future career. Banathy (1992) offers useful guidance on the development of a process model. It should note how a school receives referrals and how it assesses the needs of the children referred. It should then show how this information is used in the life of the school. Taking stock of the total picture presented by the process model allows judgements to be made on the adequacy of school functioning.

Banathy refers to the process model as a 'moving picture' type of analysis. However, it is possible to stop the 'frames' of the moving picture at various natural event points in the series and to consider these change points as phenomena for critical analysis (Dunn & Hamilton, 1986). To gain access to this sort of information interview schedules were developed for use with the Centre management, to obtain views on current developments, prospects and plans, and cross-referred with parental interviews and interviews with relevant personnel from the children's education authorities about experiences and expectations. These were repeated over time and interviews were also held (mainly by telephone) with education authorities who by the end of the evaluation period had not yet sent children to the Centre.

The questions about process for the various informants covered the following four main areas:

- policy developments in relation to Craighalbert;
- the place of Craighalbert in relation to other provisions;
- the impact of Craighalbert on practice;
- perceptions of Craighalbert.

These interview schedules helped in the tracking of event and change points. In the simplest sense they helped to track a child's contact with Craighalbert, in terms of referral, admissions, provision, review and transition. This in turn generated further questions about the system as a whole and its separate parts and also indicated points at which possible future developments in the system might be expected.

The Systems Environment Model

This model shows how a system such as a school fits the context of its community and the larger society. In particular, it deals with identifying concepts and principles that govern relationships and interactions among the individuals and agencies who constitute the wider context. Conversely, the model may also be used to examine the responsiveness of the context to the school. Clearly, the niche that a service intends to fill or carve out for itself may be quite different from the space made for it in the network within which it is to operate. Therefore, the natural and complementary strategy is to investigate the meaning which the service has in the minds of its users and potential users. This calls for an array of methodological techniques.

Interviews with education authorities, described above, provided systems environment information as well as comments on process, in their role as surrogate purchasers of a service. In exercising their purchasing choices they explicitly or implicitly exercised expectations about the role and place of Craighalbert. Questions were asked about resources, practices and procedures regarding children with cerebral palsy and policies in relation to conducting and costs and effectiveness in relation to conducting and to placement in Craighalbert.

Children's families can also be considered as part of the environment in which a school operates, in particular their extended families and communities. Parents interviewed were asked about how they and their social networks perceived the Centre and what they felt in particular it had to offer. [Locus of control scales (Lumpkin, 1985) were used to gain extra information about the processes of parental choice.] In the particular context of conductive education the network of professionals who practice aspects of conducting in the UK and abroad are part of the relevant environment, as also perhaps are groups and charities concerned with the well-being of physically disabled children. National government policies can be expected to have considerable influence and in Scotland these are mediated through Her Majesty's Inspectorate of Schools. Whereas the process, function and structure models are particularly appropriate for examining perceptions of the providers of a service, the systems environment model illuminates the response of its users.

The Holistic Picture

Recording the unique perspectives of each of the system's providers and users provided a wealth of information offering different insights into many of the same issues. Individual outlooks could thus be compared, resulting in as full a triangulated analysis as possible. This aided the conceptualisation of a service as a three-dimensional living system, embedded within a fuller network and interacting in various dimensions. The longitudinal nature of all facets of investigation allowed for a flexible outlook on the developing shape of the Centre and on its relations with the context into which it had to fit.

The use of the systems analysis approach provided a framework which helped to organise the information obtained and to ensure that a purposeful path could be drawn through the complexity evidenced. At each stage interesting pointers for service development emerged and the iterative nature of the analysis meant that change over time could be tracked. A fairly time-efficient procedure such as a structured interview could gain information pertinent to many aspects of the model, by use of specific questions, but there was a certain amount of interdependency, where the responses to interview questions crossed over the model boundaries; describing not only processes, for example, but helping to generate issues for examination in the functions, structure and systems environment aspects of the study. This paper has not been concerned with the findings of the evaluation, but many issues of agreed relevance to the development of the Centre and to the practice of conductive education in general emerged (MacKay *et al.*, 1996).

The quadrant adaptation of the systems approach proved useful, allowing the separation of relatively immutable and perhaps externally imposed components of provision, and is recommended for future use. However, the research paradigm is not yet 'third generation' designing 'within' the system and the format of the research evaluation using outside researchers may have imposed a role which was rather too judgemental (Chinapah & Miron, 1990). Modern systems analyses would deal with such problems of liberating knowledge by involving Centre staff in the 'creativity' phase of the analysis (Flood & Jackson, 1991). The model discussed would, however, still remain useful and the overall evaluation approach provides a flexible and sensitive way of gathering information which retains a proper emphasis on pupil attainment but places it in a context where its relative importance can be appreciated.

Such approaches perhaps deserve more widespread use in the field of educational evaluation.

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