INTRODUCTION

In its relatively short history, Imaginative Education has been able to create a stir in the educational community. It claims to address the perennial issue of learner disengagement. Imaginative Education proposes that, by directing education to the imagination, educators will be able to engage learners, efficiently and effectively, with the desired curriculum. This paper aims to test that claim. Evaluation of any program is a messy business and requires time. Since Imaginative Education is relatively new, the data required to test its effectiveness may have to be collected well into the future, by which time I may well be dead. This might be a good thing, as human history supports the notion that one must be dead before one's ideas are thought to be worth anything. Artists, scientists and philosophers whose names are used with reverence now, were often ridiculed when they were alive.

But I digress. Dead or alive, I am charged with the task of evaluating Imaginative Education. Is it a worthy program for educating young minds? Is it fulfilling its promise as a coherent, theory-based course of study that accesses human imagination to engender cognitive growth? Has Imaginative Education helped learners develop their ability to do 'real' work?

Educational program evaluation is often based on the premise that what is worthy in a program can be measured. Indeed, that premise often manifests itself in the attitude that ONLY what is measureable has worth. Yet under this broad umbrella of program evaluation, lies a spectrum of methods that range from rigid accountability models to more holistic, aesthetic models. They range from dissecting and measuring the parts to

immersion in the program and allowing it to tell its own story. One end of the spectrum imposes its agenda while the other end of the spectrum absorbs the essence. I tend to embrace an approach that balances the extremes of the spectrum, as it is often in the middle that we discover a blend of ideas that is the most insightful.

A SURVEY OF PROGRAM EVALUATION

Program evaluation has become de rigeur because it is characteristically human to want value to be added through our endeavours. Progress is defined as going forward towards a goal and continuous growth is perceived as desirable. Hence there is significant investiture in making everything grow. Regression, or even stagnation, is an undesirable state of affairs. There is a strong impetus for educational endeavours to, not only grow, but to demonstrate that growth. The only way to do that is to evaluate whether educational programs are achieving their stated objectives over time. Thus program evaluation was hatched in Great Britain in the 19th century and emerged soon after in the United States. It has grown exponentially ever since and educational programs now seem to be evaluated relentlessly. Indeed, in many quarters, evaluation is now viewed as an integral part of the education process.

How did program evaluation, in a relatively short 200 years, grow from an adjunct to education into a giant, lumbering beast that threatens to grind the wheels of continuous growth to a screeching halt? The story of program evaluation may be summed up in the shifting titles "It seemed like a good idea at the time" to "The blob that ate the world". In the beginning, evaluators were deeply interested in the questions of how the interconnected features of a program worked together to reform society (Stufflebeam et al,

p. 4) and how to engineer uniformity, both in products and in systems (Stufflebeam et al, p. 5). Both questions have as their core motive, the desire for quality and fairness for all. But as the field of program evaluation developed through seven 'Ages', as Stufflebeam suggests, there was a considerable shift towards an Accountability model of evaluation. This coincided with large infusions of government funding into education programs as well as into the evaluation of their effectiveness.

The Accountability approach is not as benign as it may first seem. When educational goals are superseded by goals of 'return on an investment', then this type of evaluation becomes intrusive and changes the nature of the program being evaluated. For instance, an evaluation that focuses purely on attainment of learning objectives will change the trajectory of a program towards a 'teach to the test' mindset. Thus, the evaluation, instead of reporting on the effectiveness of the program becomes the driver, forcing the program to adapt to meet the objectives of the evaluation.

The quest for effectiveness lends itself quite naturally to quantification. But quantification in education seems to have settled on 'easy' measurement – such as, test scores of learners' knowledge and comprehension, graduation rates and mean scores. None of these measurements give any indication of the more intangible qualities of a worthy education program. Clearly, a purely statistical analysis of programs ignores many desirable qualities because they are difficult to measure. But instead of giving up on the measurement of elusive qualities such as, the quality of relationships within a school community, perhaps what is needed is a different kind of quantification.

Some researchers hold the view that one must make a choice between quantitative and qualitative evaluation methods. The contention that program evaluation errs too much on the side of quantitative methods has merit. Elliot Eisner (1985) is perhaps the most vociferous advocate of regaining some balance in program evaluation. He argues that qualitative evaluation in the form of connoisseurship or educational criticism is necessary to evaluate those valuable qualities of a program that do not lend themselves easily to quantification. Michael Patton (1997), on the other hand, declares the debate of quantitative versus qualitative evaluation as over, "since qualitative methods have won parallel respectability to quantitative methods of evaluation" (p. 266). He espouses a mixed-methodology approach. Patton argues that both quantitative and qualitative methods are necessary to evaluate different aspects of educational programs.

One method of qualitative evaluation that seems to get mentioned only in passing is portraiture. Sara Lawrence-Lightfoot (1983) describes a method in which the evaluator paints a portrait that captures the essence of a program. She writes

> As a social scientist I wanted to develop a form of inquiry that would embrace many of the descriptive, aesthetic, and experiential dimensions that I had known as the artist's subject; that would combine science and art; that would be concerned with composition and design as well as description; that would depict motion and stopped time, history, and anticipated future. (p. 6)

There seems to be merit in this approach that seeks to merge the quantitative and qualitative into a holistic impression of a program. A feature that seems particularly worthwhile to consider is that of time. Lightfoot incorporates into her reports the long view of educational programs. She points out that "a persistent problem with social scientists' pursuit of effective schools, or their critiques of poor schools, is that they often view them

as static... (using) methods of inquiry (that) are ahistorical and do not allow for an

evolutionary view" (p. 24). The method of portraiture appears to hold the key to unlocking

the barrier between quantitative and qualitative methods of program evaluation, as well as

painting a portrait of a program from the multiple perspectives of its participants over a

period of time.

This article will outline, what I believe to be, a more sophisticated and meaningful

way to quantify qualitative data, Mathematical Modelling. In a mathematical model, one can

input trends in different qualities and examine the impact they have on each other. This

technique has been used quite effectively in economics and other social sciences, but I have

found no evidence that it has been used in evaluation of education programs. My

proposition might be unique in that instead of 'mixed-methods' as a bag of some

quantitative and qualitative methods applied side by side, mathematical modelling is a

mixed-method converged in one technique – 'mathematical portraiture', if you will. Despite

Howe's (2009) assertion that

> ...quantitative and qualitative research methods are incompatible with one another
> such that they may be combined "disjunctively" but not "conjunctively" (p. 2)

I believe that the quantitative research methods, to which he refers, have relied too heavily

on statistical mathematics. The blanket use of statistics can reduce information to norms

which mask the valuable insights to be gleaned from the extremes of continua. Also,

statistics often exclude opinions or impressions held by participants in a program, which

may hold the essence of what is important to those whose lives are affected by such

programs. My proposal is that it may be instructive to shift to a different kind of

quantitative analysis - the use of mathematical modelling.

A legitimate question would be why should we quantify at all? Firstly, quantification gives access to the synergy that is produced when variables interplay with each other. It is a way to give value to that which is more than the sum of the parts. Secondly, quantification is efficient. A textual description of an education program will require many pages and hours of reading to create an impression of a program whereas a quantified picture reveals more in a shorter time. Thirdly, quantification increases clarity. I believe it is mistaken to characterize quantitative evaluation as a means of increasing objectivity. To make wise decisions about the worth and future of education programs requires the emotional investment of the evaluator. This is a profound responsibility that requires clarity of analysis rather than objectivity. For these reasons, I believe that mathematical modelling could be useful as a method for quantifying the elusive qualities of an education program.

MAPPING THE LANDSCAPE OF A PROGRAM

The process of modeling might be defined in the following way

- Identify the problem to be investigated
- Determine the important factors
- Represent those factors and their interplay in a mathematical way and analyze the mathematical relationships
- Interpret the mathematical results in the context of the real-world phenomenon
- Evaluate how applicable the results are to the real-world situation.
- If necessary, re-examine the factors that were considered and structure of the initial model   (Jennings, p. 3)

The purpose of this article is to devise an evaluation method for the Imaginative Education program. Since this is a unique program based on Dr. Kieran Egan's Theory of the Educated Mind, it is not surprising that no evaluation method, quantitative or

qualitative, presently articulated seem to quite fit the evaluation needs of this program. Indeed, it feels like one is watching a 3-D movie without the special glasses – something is out of focus, when trying to fit one or more of these methods to the evaluation of Imaginative Education. There appears to be a need for a multiplicity of perspectives that no one evaluation method can provide. On the other hand, a mish-mash of mixed methodologies does not seem to fill the need either, as mixing and matching from different approaches may lead to an incoherent picture that confuses rather than illuminates.

Before we evaluate it, we may want a synopsis of what Imaginative Education is. Dr. Kieran Egan proposed that the way we make meaning of the world is through 5 ways of understanding – namely, Somatic, Mythic, Romantic, Philosophic and Ironic. Associated with each way of understanding, are specific mediational means ('cognitive tools') which educators can use to access the learners imagination - where the most efficient, effective thinking happens. For example, one of the mediational means of Romantic Understanding is Extremes and Limits. So when a learner asks us to define the extent of what they are required to know, they are not being lazy thinkers, they are in fact trying to find comfort in knowing the Extremes and Limits of a particular topic. They need the confidence of knowing the boundaries of that knowledge before they can risk going beyond those boundaries to explore through Philosophic Understanding, the anomalies of incongruous ideas that just do not fit within the limits of what is understood through Romantic means. The implementation of this Theory forms the basis of the work in Imaginative Education.

To match the unique nature of Imaginative Education, perhaps a unique method of evaluation is required that is neither quantitative nor qualitative, but fuses the wisdom of both approaches - a true resolution of polar opposites. Mathematical modelling offers such an opportunity. An example of a mathematical model may serve to illustrate. Consider the Law of Variable Proportions (Diminishing Returns in Economics) as a mathematical model. Dr. Paul M. Johnson (2005) illustrates this with a simple gardening example. In a fixed plot of land, based on standard gardening practice, perhaps a yield of 50 tomatoes can be produced. If another variable, one pound of fertilizer is added, then the yield will increase to say, 100 tomatoes. But if 2 pounds of fertilizer is used, the increase in yield of tomatoes will increase but not at the same rate as with the first pound of fertilizer. Increasing the amount of fertilizer will not continue to increase yield, but will rather burn the plant roots and produce no tomatoes at all. In this example, one variable, plot size is fixed and the other, fertilizer is variable, but not infinitely so. This model may be represented pictorially as
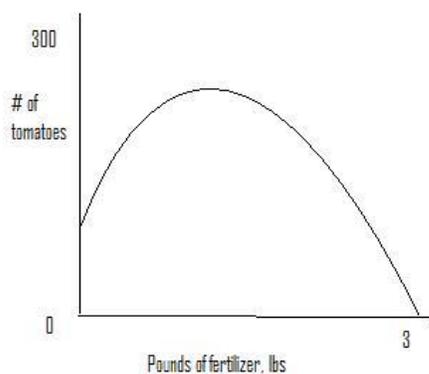
In terms of evaluating education programs, there will be multiple variables which need to be factored into the worth of a program. This will make the modelling more

complex but not unmanageable. The next section of this article will focus on 5 qualities that can be used to determine the worth of a program: responsiveness of the program to learner needs; opportunities for learning; relationships with peers/teachers/community; learner facility/competence and emotional comfort. An overarching 6th quality will be time, as a program in its infancy will have a different portrait from one that is emerging or well-established.

THE PIVOTAL PREMISE

Imaginative Education claims, as its unifying theme, that the imagination is central to the development of the mind and that the imagination can be developed in the process of educating the mind. These two aspects of the claim are inseparable from each other. Imaginative Education may be described as the semi-permeable membrane that enlists and develops the imagination concurrently, and in so doing, develops the mind of the child. That is a bold claim. It is also one that is highly desirable and if proven to be effective, can result in an evolution in education unlike anything experienced in the past one hundred years.

My aim in this article is to put this claim to the test. I shall do this through the analysis of both quantitative and qualitative data that disclaims the null hypothesis "Imaginative Education has no significant effect on the development of the mind." Further, the data for this evaluation will be drawn from all participants. Learners, educators, parents, administrators and interested members of the community (volunteers, neighbours, etc.,) all have a vested interest in the success of any education program and, as

such, should have informed input into any measure of effectiveness. It is the evaluator's

task to balance the multiple perspectives of all participants so as to create a coherent

portrait of the program. This portrait must be informed by all involved, incorporating the

many points of view to reveal the program's essence, which is more than the sum of its

parts. Each participant's input will be used to generate a mathematical model, which is the

tool to be used to determine program effectiveness.

I think it is fair to state that present forms of program evaluation do not find favour

because they are either too simplistic, being condensed to a single quantity devoid of

meaning, or they are so descriptive that they become mired in the details losing sight of the

big picture. Indeed, some attempts at qualitative evaluation may also descend into

meaninglessness. For instance, what does 'meeting expectations' really mean to a parent?

Whose expectations? How did the evaluator determine that the child 'met' the

expectations? How were they introduced, anyway?

The success of Imaginative Education is dependent on five key principles:

- The web of relationships within the community

- The emotional climate of the program

- The variety of opportunities for learning

- The responsiveness of the program to learner needs and

- Learner facility/competence with systemic knowledge.

It is the last of these principles that can be used to gauge the effectiveness of the program in

developing the mind of the child, but the interconnectedness of all five principles and the

synergistic effect they have on each other, can provide valuable insights into how the

program works. These five principles also reflect what is unique about Imaginative

Education as each one can be seen as a means of enlisting the imagination.

The web of relationships within the community

It may be argued that every program is affected by the web of relationships within

the community. It is the extent to which that is so that makes Imaginative Education

unique. The program is dependent on strong relationships with as many participants as

possible. Learners, teachers, parents, administrators, volunteers, support workers all

collaborate in the common purpose of building competent minds. If participants work at

cross purposes, then the vibrancy and energy of the program is sapped and the group

dynamics act counter productively. Therefore, fostering both quantity and quality of

relationships within the entire community becomes vital. In Imaginative Education, the

role of the mediator of the child's understanding is to recapitulate humanity's collective

systemic knowledge and hopefully, in time, to go beyond the already known. That

mediation can take place at any time with anyone. Greater epistemological connections

happen when multiple mediators (not just teachers) create multiple opportunities for

learning. This encourages learning in a more memorable way.

The emotional climate of the program

Again, every program has an emotional climate. However, the emotional climate of a

distance education program may not be as much of a priority as it is in an Imaginative

Education program. An emotional climate that is safe, tolerant, inclusive, supportive,

inspiring and any other positive attributes that a program may value, takes centre stage in

an Imaginative Education program. These features are measurable indicators of a healthy

emotional climate. In an Imaginative Education program, learners are asked to access their

emotions and this can put them in a vulnerable state. Therefore, the emotional climate

must be crafted cleverly and monitored closely as irrevocable harm can be done to the

individual if negative, predatory interactions happen.

The variety of opportunities for learning

A useful principle to remember in education is that 'one size never fits all'. A variety

of opportunities to learn is required across a group, as well as within an individual. The

role of the teacher then becomes more like that of a juggler, keeping many balls in the air at

the same time coupled with the ability to pull things out of the air to address the moment-

to-moment needs of learners. I recognize that this is an exhausting, idealistic way to look at

the art of teaching, and would limit the number of teachers qualified to teach this way; but

from the point of view of the learner, a space that allows myriad opportunities to access a

concept would be a dream come true. 'Variety' is an easy thing to count. We can then make

the correlation that that if there is optimum variety then there is optimum opportunity,

both for the group and for the individual. A snapshot of an Imaginative Education program

might then show small groups or individuals working in different ways on the same

concept.

The responsiveness of the program to learner needs

Many learners report that their questions go unanswered because in a typical

classroom the teacher is the 'holder of the answers' and the learner must wait her/his turn

to have that one-to-one contact that will address the question. To enlist the imagination in

learning requires more immediate feedback and mediation to avoid the imagination getting

stuck in its unrelenting quest for the evolution of meaning. This means that more fluid

interactions have to occur on an ongoing basis for meaning-making to be facilitated. This

can be gauged through both the number and total duration of interactions between

learners and mediators, both human and non-human, such as keen observation of the

natural world.

Learner facility with systemic knowledge.

The bottom-line for any educational program has to be what the learners know. The

understanding of concepts must be examined beyond the level of regurgitated facts or

memorized connections. It must be ascertained whether learners are able to go beyond

ideas explicitly taught and apply what they know to completely new, but analogous

situations. This is a complex task requiring data from multiple sources in order to make a

valid determination of learner competence. One measure could be the learner's self-

reporting of feelings of competence but this would have to be verified by external means as

well. For example, instead of the usual test items, a learner might be asked to list the steps

involved in the solution of Question A rather than being asked to provide an answer to

Question A.

COLOUR BY NUMBERS – PAINTING A MATHEMATICAL PORTRAIT

One instrument that could be used as part of a set of evaluation tools is a

mathematical model, which I am calling a 'mathematical portrait', inspired by the concept

of portraiture as conceptualized by Sara Lawrence-Lightfoot. One shortcoming I see with

portraiture is the inability of the reader to see any quantified data in the portrait. Where

are the numbers? The value of mathematics in an evaluation is that it describes the world

in incremental amounts that are subject to change analysis. A mathematical portrait affords

the opportunity to look at what qualities need improvement and by how much.

The data to be input into the mathematical model will come from the participants

themselves. Everyone connected to the program will be invited to complete a survey, of

approximately 20 questions, that rates each quality on a scale of 0 to 10, 0 meaning that the

quality is non-existent to 10 meaning that the quality is operating at an optimal level. The

survey questions would need to be triangulated to increase accuracy of the readings.

Depending on the age of the children involved, the survey questions may be administered

orally. Then the ratings would be plotted on a graph to show the frequency of each rating

and this will generate the mathematical portrait.

An example of a set of survey question could be

"On a scale of 0 to 10, rate yourself on the following:
1. I feel a sense of accomplishment when I work with my classmates to solve a problem.
2. I feel a sense of accomplishment when I work alone to solve a problem.
3. I feel a sense of accomplishment when my teacher guides me to solve a problem."

The following diagrams will illustrate idealized mathematical portraits for early,

emerging and established programs. Since the length of time a program is in operation will

have an influence on its efficacy, a young program cannot usefully be compared to the

expectations of a well-established program. These diagrams are the result of a conversation

I had with my son, Matthew. I was trying to express the idea in my head, in words, and was

doing a very poor job of it. It was my son who suggested that what I was describing

sounded like a mathematical model. This is only a fledgling idea and I would have to

generation an equation showing how each quality interacts with the others for it to be

considered a fully formed mathematical model, but I think the idea is a useful one to

pursue.

Early
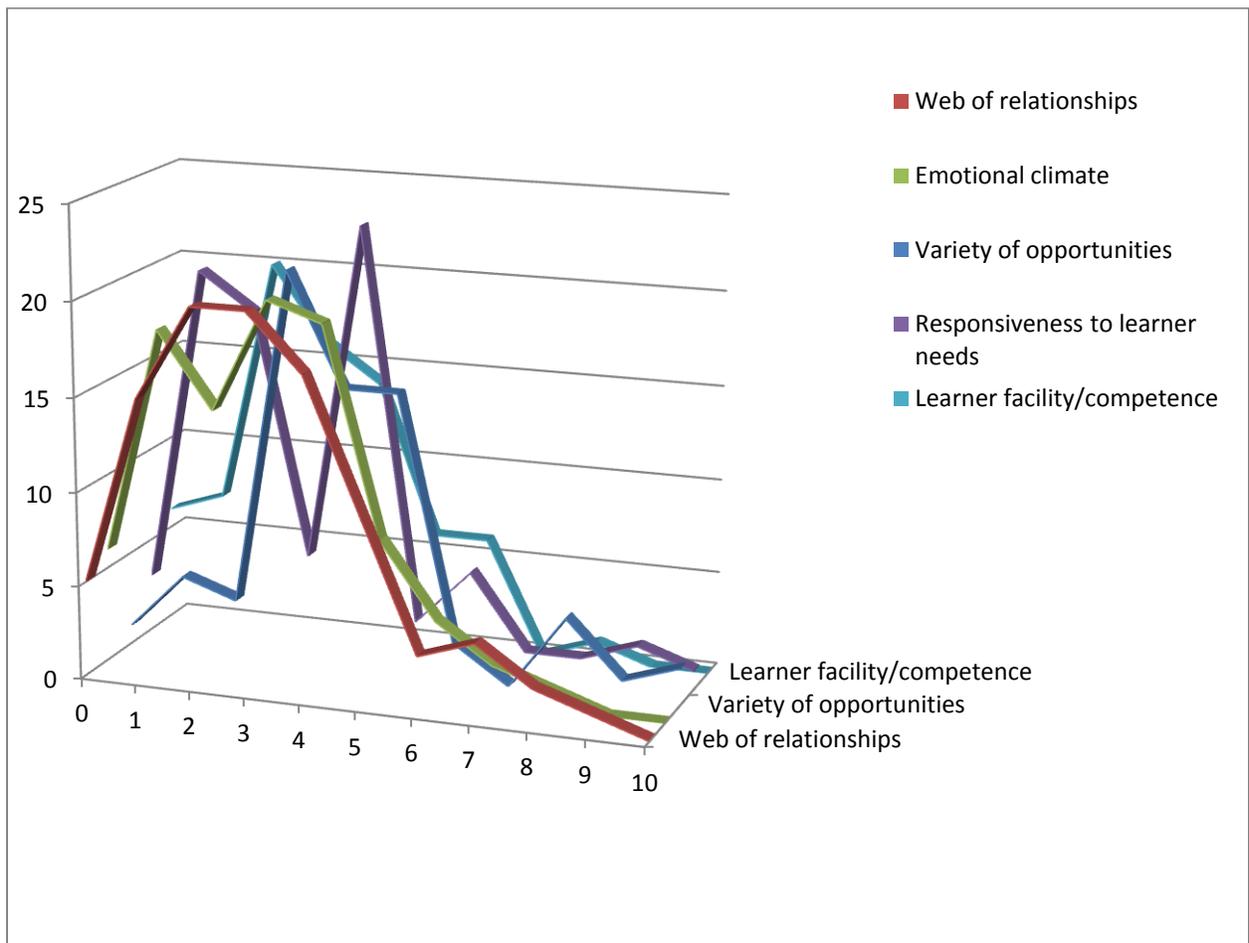
In the early years of a program, these five qualities may have a low rating, but as long as they are present to some degree, we can infer that Imaginative Education is having some impact on learners and our null hypothesis will be disproved.

Emerging
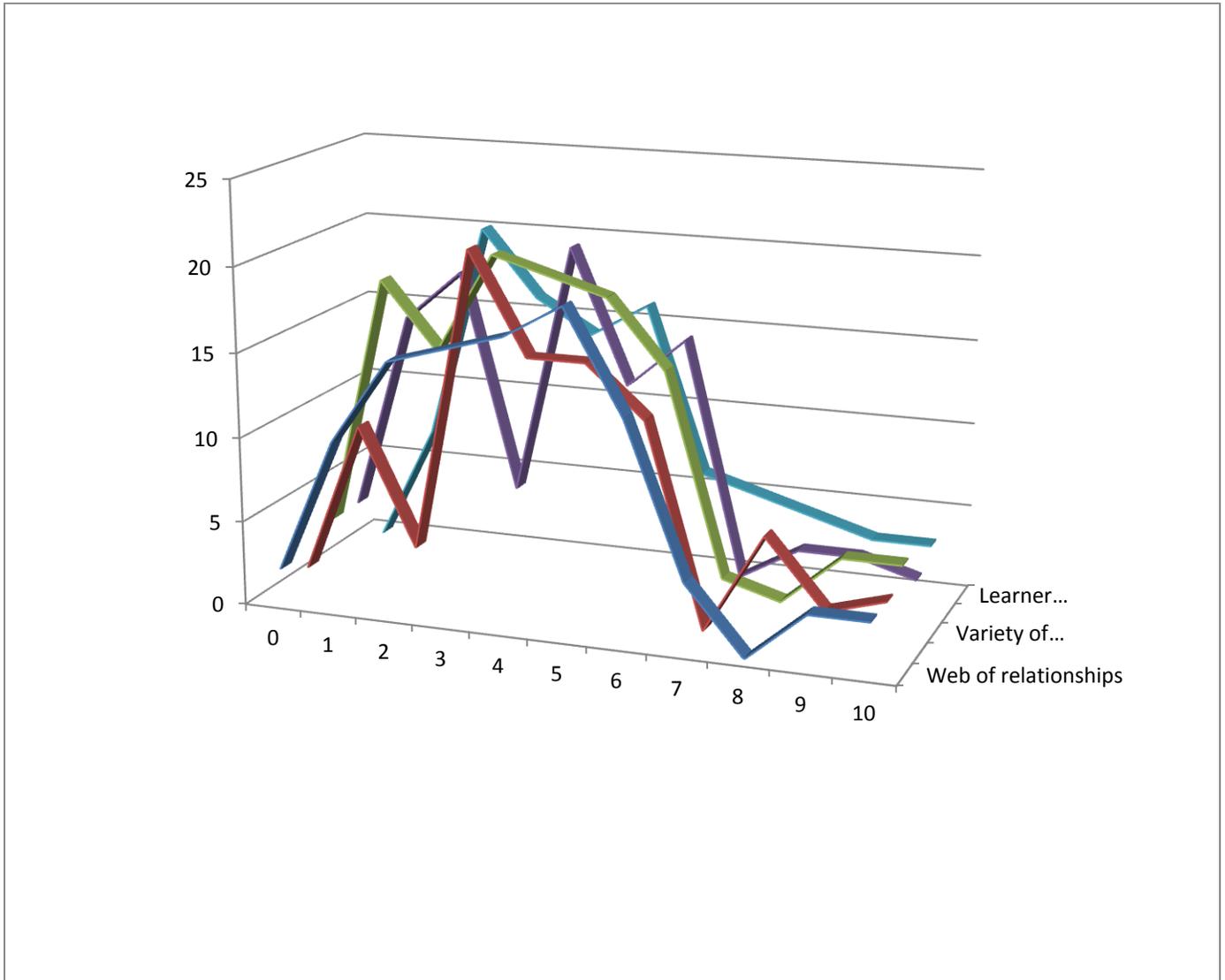
After some years of operation, the logistical 'bugs' in a program will have been eradicated and a shift in the trends towards 10 will indicate progress.

Established
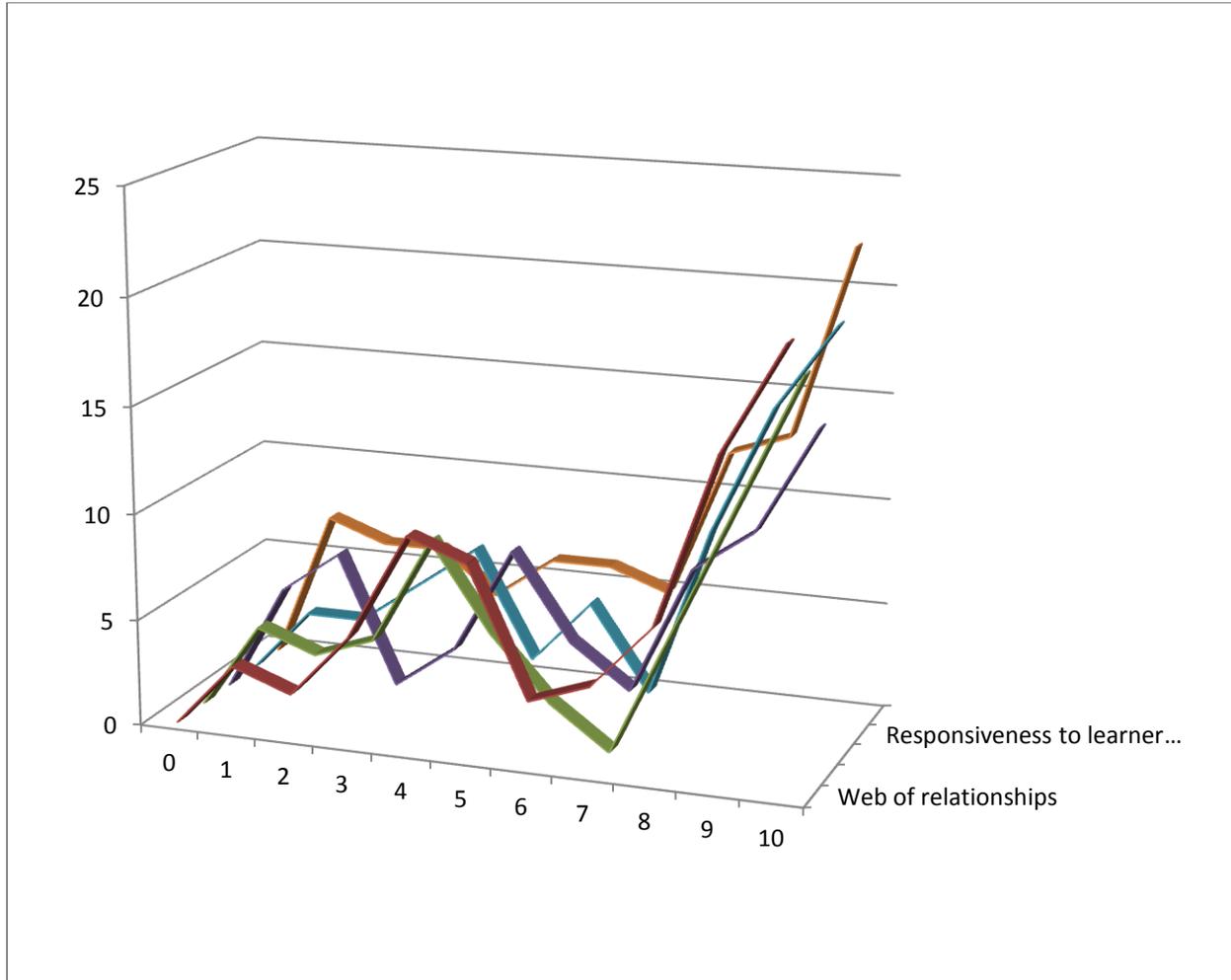
Once a program is well established, it is expected that the program will be able to deliver what it set out to do. New learners coming in will have the benefit of the collective wisdom of the past, informing the present and influencing the future.

On another level, this mathematical model can be set up to take into account the influence of one quality on another, for example to investigate whether there is a directly proportional relationship between a strong social web and engagement with systemic knowledge. This second layer of connection requires further investigation, as a different

mathematical function would be needed to determine whether there is a correlation between these two variables. Another possibility for further investigation might be whether there is an optimum number and level of social connections to enhance learner competence.

CONCLUSION

In conclusion, one of the major concerns with program evaluation in its present form is that while logical, objective methods appear too cold and detached, aesthetic, descriptive methods appear too warm and fuzzy. Either extreme makes people uncomfortable. I believe that mathematical portraiture has the potential to satisfy our need for 'cold, hard facts' presented in an aesthetic way that allows us to see the bigger picture of a program. Whether that picture is flattering or not, the graphical representation of important qualities will grab the heart and mind in a way that digits in a table never could. The three dimensional nature of this method of evaluation allows another layer of connections in the complex world of education. Seeing a pattern emerge from the numbers may be the undeniable story that galvanizes us into action. If a picture paints a thousand words, then perhaps a portrait will inspire the one action that advances a program.

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