

# The Evaluation of Electronic Books

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## SUMMARY

Is there a future for electronic books in education? This paper presents a preliminary evaluation of two categories of electronic book, reference-type and textbook-type, from an 'outward' perspective, focusing on implementation likelihood in school and university settings. The so-called '3G approach' is combined with a 'cost-expectation' perspective to provide a theoretical framework for making predictions about the future of electronic books and for making recommendations to increase the likelihood that electronic books will have an educational future.

## EVALUATING ELECTRONIC BOOKS – PRELIMINARY QUESTIONS

The task of suggesting a frame of reference and a procedure for evaluating electronic books is an interesting one. Three preliminary questions must be addressed when talking about any kind of evaluation: What are we evaluating? What is the purpose of the evaluation? What is the theoretical framework that guides our interpreting the data? We will look briefly at some alternative answers to these questions relative to electronic books and, from the alternatives, choose a particular position to develop further in this article.

### What are we evaluating?

When we talk about evaluating electronic books, there are a number of ways that we could be conceptualizing the evaluation object.

#### *A metaphor?*

Barker and Giller (1991) say that 'an electronic book is essentially a metaphor – one which is based on people's perception of traditional paper-based books' (p. 1).

#### *A new type of book?*

Barker and Giller, in another article (1990), define a conventional book as 'one in which paper is the medium upon which pages of information are

displayed' but 'unfortunately, committing a page of information to paper renders that information unreactive, static and time invariant' (p. 13). In contrast, they see an electronic book as one whose pages 'can be made reactive, dynamic and time variant . . .' (p. 13).

#### *An authoring environment for this new type of book?*

Barker and Giller go on to say that 'the pages of an electronic book need not actually exist until they are needed . . . created in real time as and when they are required from a multimedia knowledge corpus that is resident either on magnetic or optical storage media' (1990, p. 13). From this perspective, the focus seems to be more on the authoring environment for electronic books, than on the 'books' (as products created by the end-users) themselves.

#### *A new type of electronic database?*

Barker and Giller say that 'the simplest type of electronic book consists of a computer-controlled data source along with a sophisticated data retrieval system' (1991, p. 1), a definition that fits their subsequent categories of 'archival' and 'informational' electronic books. The data retrieval system can be based on hypertext principles. When electronic books are thought of from this perspective, the distinction between them and hypermedia stacks, particularly those



stored on CD-ROM, is often unclear (see, for example, Riddle, 1990).

#### *A specific product?*

For example, the commercially available *New Grolier Encyclopedia* (Grolier, 1988) or examples under development, such as those on quantum theory (Burnett, 1991) or screen design for computer-based training (Barker, Giller and Richards, 1990).

#### *A direction for possible future development?*

As, for example, the 'Instructional' classification described by Barker and Giller (1991) "Some electronic books in this category will actually assess and adapt to the user's personal learning style. Such books automatically re-configure the material presented to accommodate the user's preferred approach to learning (p. 2); or their 'Interrogational' classification, containing 'a question bank, a testing and assessment package, and expert system' (p. 2)".

Thus we see that, just as when we talk about evaluating educational software, we must be careful to define our terms when we talk about evaluating electronic books. For this short paper we will delimit our task by considering electronic books as either automated reference books or automated textbooks (recognizing, of course, that these are simplistic categorizations, that the categories will often overlap, and that the full potential of electronic books may result in something that is different from either textbooks or reference books).

The reference book approach can be illustrated by electronic databases or print encyclopedias. This kind of book functions as a resource; users will turn to it primarily to find or browse through some subset of the information within. It is easy to picture electronic books in this reference category; the extensive literature on hypermedia stacks offer many examples, and automated encyclopaedias have been commercially available for a number of years. The future will see dramatic improvements in both the quantity and quality of what is stored in these databases and in the ways in which the user can find and take information from them, but the functional model remains the reference book idea. The textbook approach differs from this in that the user is generally expected to move through the book (or at least portions of it) in the sequence

determined by its author, reaching definite learning targets along the way. Electronic book embellishments of this textbook model will allow the user to augment his or her understanding through detours of various sorts. Great possibilities exist for these detours – in terms of media, in terms of tutoring or coaching, and even in terms of providing embedded reference-type electronic books, but the general goal of using an electronic textbook remains that of using a 'traditional' textbook – learn what's in it. Again, these are simplistic conceptualizations, but adequate here for our purposes.

#### **What is the purpose of the evaluation?**

There are also simplistic ways to characterize the purpose of evaluations. A convenient distinction is between formative and summative purposes – How can we improve this product while it is still 'being formed'? How can we improve our design principles? Was the product successful? Another approach is to think of evaluation either from the 'looking inward' perspective or the 'looking outward' perspective. The former approach focuses on the product itself or perhaps also on the user-product dyad and asks questions about how the program or perhaps the learner is functioning and how the program could be improved. The latter approach considers the overall fit and effectiveness of the product in the educational settings in which it will be used.

#### *Looking inward*

The 'looking inward' approach is a very familiar one with computer-assisted educational resources. We know the type of general evaluative questions: Is the product easy to use? Are there technical problems or failures in the product? What are the affective reactions of users to the product? How successfully can the users handle the main features and functions of the product? How well does the user interface fit the characteristics and needs of the user? How adaptable is the product to the characteristics and needs of different users?

These questions are general to any electronic learning resource and thus are also going to be familiar categories of evaluation questions for electronic books.

In addition to this general type of question, each of the two categories of electronic books that we have



delimited for the purposes of this article has its own set of general questions. With respect to the reference-type electronic books, major questions relate to indexing and user navigation. There is rapidly growing experience with respect to issues related to user navigation and enquiry support in hypertext systems, where problems related to disorientation, navigation inefficiency and cognitive overload dominate the literature; (see for example, Hammond, 1989; Jonassen, 1989; Neilsen, 1990; Osborne, 1990; Raper and Green, 1989). Effective indexing and cross-referencing of reference items has, of course, been an important issue to archivists long before electronic databases and hypertext. Another general criterion for evaluation of the reference book type of electronic books relates to the adequacy of information contained in them, where adequacy is a function at least of depth, breadth and timeliness.

In contrast to reference book issues, where navigation within information resources rather than attainment of pre-specified learning targets is the general priority, our second category of electronic books, based on the textbook model, suggests general evaluation criteria relating more to learning-oriented outcomes. Major questions here are similar to those we ask of tutorial software: How well do different excursions help different types of learners reach the learning goals?

#### *Looking outward*

The 'looking outward' approach looks instead at as broad a view as possible of the real-world educational setting in which the product hopes to function, and tries to see how and if the product will function there as intended. We could call this an implementation approach, or a market approach, because a basic (simplified) question within this approach is: Will the product be a success? – ie will the target group like it, want it, buy it, use it? For this to happen, the target group must believe that the result of using the product is worth the money and effort involved in acquiring and using it.

Publishers of traditional educational books, either reference or textbook types, use both of these evaluative perspectives. The 'looking inward' approach is a necessary but not sufficient part of evaluation and decision making. It is not enough that a book is well done, rich in its own way; it must

be something that people want, can afford and can use. It has to sell on at least a broad enough scale to recover its investment.

This elementary discussion of the marketing strategies used by educational book publishers may seem out of place in the context of electronic books, where the 'inward looking' questions that are now starting to be asked often relate to issues in specialized scientific areas, such as sophisticated instructional design issues, or cognitive processing models, or software engineering issues involved in developing the architecture of electronic books, or technical issues involved in the manipulation of multimedial resources. However, it is the thesis of this paper that the 'outward' approach to evaluation is also appropriate for electronic books, even at this early stage in their evolution. Why? For the simple reason that if it appears that there is not going to be a market for the electronic book type of resources, we as designers, developers and theorists would do well to anticipate this now, either to reconceptualize or redesign electronic books so that the answer to the market question more likely becomes a 'yes', or to drop the whole exercise in favour of another direction for information technology which offers more educational application.

Therefore when we talk about the evaluation of electronic books in this article our basic purpose is to deal with the question: Is there an educational future for electronic books?

We suggest this question can be restated as: Will educational decision makers feel that the value of electronic books is or will be worth their costs?

This allows us to ask associated questions: Under what conditions will this expected value/cost prediction be likely to lead to field acceptance or field rejection? What can we do to improve the 'expected value/cost' ratio?

#### **WHAT IS A THEORETICAL FRAMEWORK FOR EVALUATION?**

Besides having a focus and a purpose, an evaluation reflects a theoretical framework even if the framework is not explicitly described. Evaluators need to have some theory driving the questions they ask, the data they collect, and the interpretation they make of the data. The 'expected value/cost' criterion that we are



discussing can perhaps get its theoretical framework from the cost-effectiveness literature. However, at the moment cost-effectiveness is a poorly developed field with respect to innovative educational technologies, in terms of both conceptualization and methodology (Moonen, 1990; Office of Technology Assessment, 1988). Moonen's suggestion to talk about a 'cost-expectation ratio' rather than cost-effectiveness is an appropriate direction for our electronic books evaluation. We will combine it with the '3G approach' to describe our framework for evaluating the potential of electronic books in education.

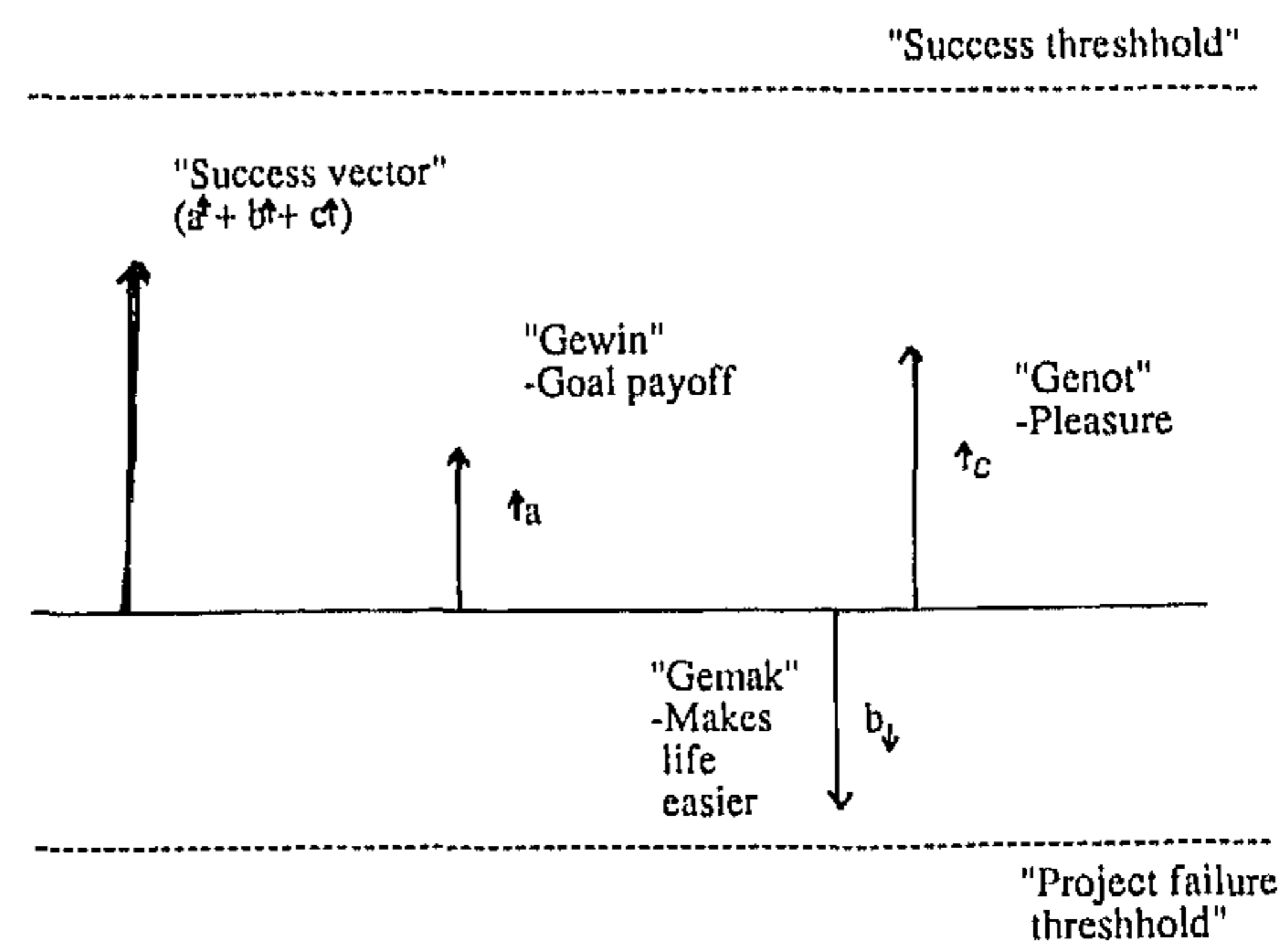
### The 3G approach

The so-called '3G approach' is familiar in the business world in the Netherlands and is used occasionally by the Dutch Ministry of Economic Affairs, although no specific original reference seems to be available for it. In this approach, a successful project is characterized by some or all of the following: (a) meaningful gain relative to the goals of the project for the participants (*gewin*, in Dutch); (b) payoff in terms of making the participant's life easier (*gemak*, in Dutch); (c) the extent to which participants get pleasure out of the project (*genot*). These vectors can overlap and can influence one another, but can also be independent of each other.

We (Collis and de Vries, 1991) have adapted this 3G approach (unfortunately, we have not yet found a good English-language acronym for it) and have applied it to the prediction of the future of telecommunications for educational purposes in a way that seems reasonably productive. It seems it may also be appropriate for evaluating electronic books, given the sort of evaluation questions we are asking.

Using this approach, it is not necessary that a project must display strengths in each of these areas (*gewin*, *gemak*, *genot*) for it to be a 'success', but to the extent that one area is weak or negative, one or more of the other areas must be correspondingly stronger. We illustrate the idea in Figure 1.

The dotted lines represent the idea of thresholds. In our interpretation of the 3G approach, we see the system as conceptually summative – the sum of the positive and negative vectors must approach



**Figure 1.** A visualization of the '3G approach' for predicting project success (Collis and de Vries, 1991). The relative values of the vectors in this diagram suggest that this project would not be seen as a 'success' (and thus would not be further implemented) as the summative 'success vector' does not have a value 'high enough' to approach the 'success threshold'.

some unit, which we term the 'success threshold', in order to increase the prediction of project success. The lower threshold suggests a level of counter-productivity which, if it is reached or surpassed by one vector or the sum of the vectors, will make the probability of success of the overall project likely to be zero. Clearly, we are using this approach in a highly intuitive way. Issues relating to how to quantify the vectors, using what sort of metric, will be complex, although we look forward to working on them. But for evaluative predictions, the approach was helpful for predicting the implementation of telecommunications in secondary schools. In the remainder of this article, we will try to combine it with Moonen's (1990) 'cost-expectation' ideas to see if it appears to be a helpful framework for our questions relating to the evaluation of electronic books.

### PREDICTING THE 'SUCCESS' OF ELECTRONIC BOOKS

Now we will turn to our exercise. First we must extend the theoretical framework so that cost ideas are incorporated in the model. Cost relates to financial considerations, but also to time, effort, organizational and psychological cost. Cost seems to enter in two ways: it can be seen as an additional vector in the system, but one that has only a negative value – if cost is too great the system will



not be implemented, regardless of its pleasure, gains, or making-life-easier aspects. Cost must also be related to the value of the success vector for the system – if the success vector is strong, the decision makers in the system will be willing to sustain considerable costs to keep the project going. The further away the success vector is from the ‘success threshold’, the less inclined the decision makers will be to sustain costs for the project.

Next we must visualize our context. Because of space limitations we will consider only the most typical educational settings: the school and the university. For each of the two general types of electronics books, reference-type and textbook-type, let us use the 3G approach to predict the likelihood of implementation within the next five years and within each of these typical contexts.

**School setting predictions**

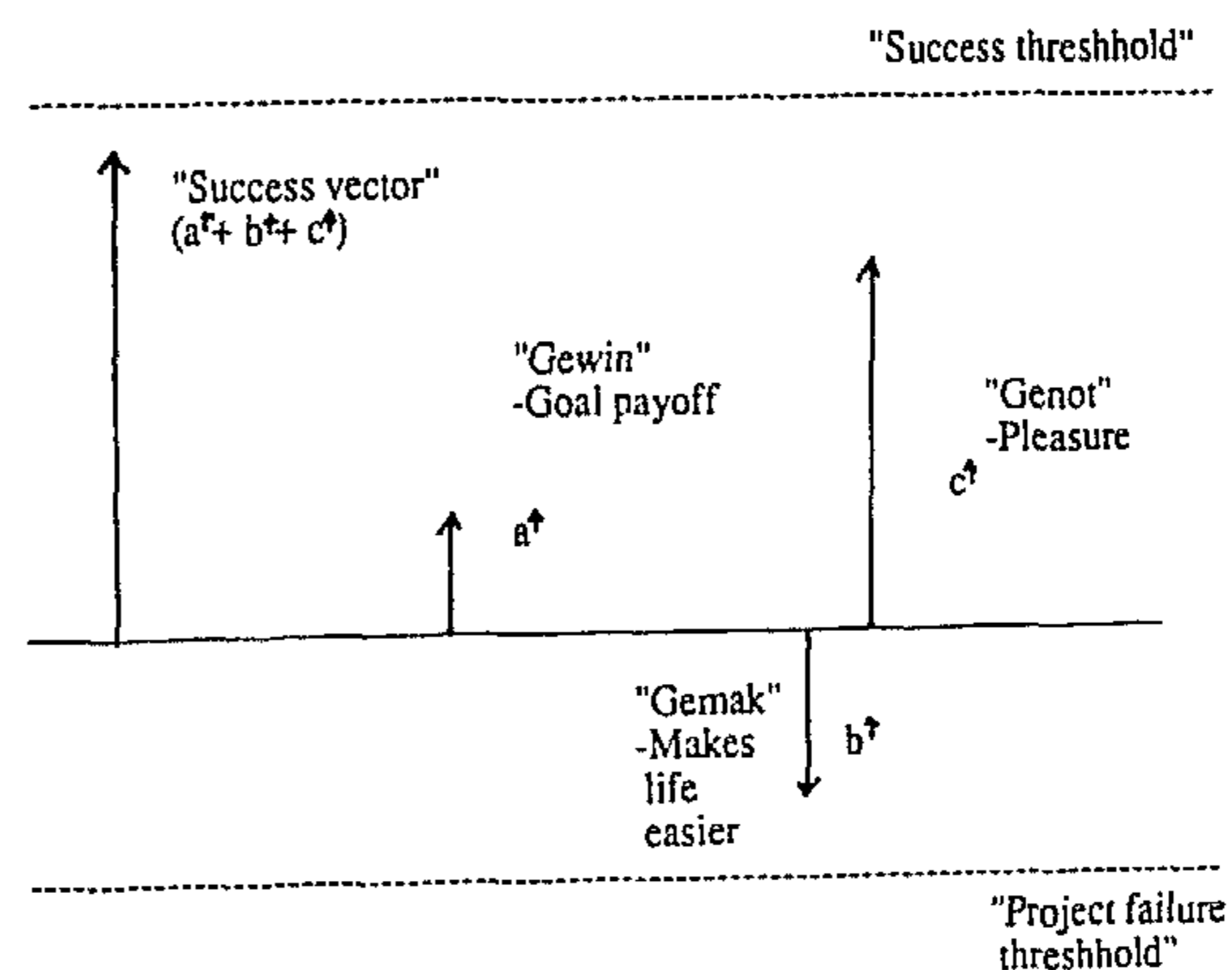
In the school setting, we can predict that students will give a relatively high value to the *genot* (pleasure) vector, for both reference-type and textbook-type electronic books. We predict, however, that the *gewin* pay-off vector will be small. With reference-type electronic resources, we know from the literature that students have considerable difficulty asking appropriate and good questions when using a database, or even a more traditional reference book. The intellectual and pedagogical problems limiting the effective use of electronic databases, regardless of what is in them or how they are structured, will also, we predict, limit their achievement-oriented pay-off in schools.

Achievement-oriented pay-off would seem to be better for textbook-type electronic books in school settings. For some subjects the curriculum is common enough among schools to form a sufficiently large and viable market for some core books, particularly those relating to early language or mathematics. (See Barker and Gillers’s ‘Electronic book for early learners’ (1990) or the commercially available Discus Talking Books series from Discus Knowledge Research. Also, it has just been announced that the State of Texas in the US has approved an electronic book as a textbook for elementary science.) However, the equipment needed to use these resources is and will continue to be extremely limited in school settings, prohibiting any meaningful sort of extended interaction for

more than a very few students. As an alternative, teachers could use a textbook-type electronic book as an instructional resource, but this leads directly to an extra burden in the ‘makes-life-easier’ vector, as this requires a change in the teacher’s familiar instructional strategy, considerable preparation, and that he or she deals with new organizational challenges (How *do* you use an electronic book in a whole-class setting?). Costs at the school level involve equipment, the electronic book resources themselves, and teacher time, energy, willingness to try something new, and instructional creativity.

*Thus our prediction?*

In the school setting, we predict that the *gemak* vector is dangerously negative, the *genot* vector is high, and the *gewin* vector is minimal for reference-type electronic books but has the potential of being stronger for textbook-type books *if* teachers find ways to use such resources effectively in a group-learning setting, to compensate for limited access to equipment and limited time to access equipment. Good teacher training will also improve the *gemak* vector. With respect to costs, clearly these have to be held relatively low in terms of money; thus core topics for electronic books have to be found that could be developed in a sufficiently large quantity so as to offset their costs. This in turn suggests younger children, where there is a greater core base to the curriculum. Figure 2 illustrates a ‘best-chance’ prediction for electronic books in the school setting within the next five years.



**Figure 2.** ‘Best chance’ prediction for electronic books in the school setting (textbook-type model, younger children, broadly-based curriculum area, stress on teacher support and implementation strategies for group or whole-class use).



What is the chance of this prediction coming true? It will require providing models for teachers of how to make use of this sort of resource in the classroom, not only stimulating the development of instructional ideas and strategies but somehow disseminating them to teachers and also supporting teachers as they try to implement the ideas in their classrooms. We know from all our other experience with computers in education that these are difficult requirements, both in terms of strategy and cost.

Designers of the textbook-type electronic book aimed for the school market should recognize this need, and work energetically to supply examples and ideas for instructional usage and integration of their product. This could include a videotape, for example, showing different teachers implementing the resource during a lesson and managing student use of the resource. Or, better still, there could be a 'teacher's chapter' as part of the electronic book itself, so that the teacher can access a collection of lesson ideas, strategies for student use in small groups etc, in as convenient way as possible while he or she is dealing with the usual classroom occupations. So, overall, the following recommendations for improving the likelihood of implementation success for electronic books in the school are suggested by the evaluation:

- *Choose the textbook-type electronic book model.* Target the choice of textbook to serve as broad a curriculum area as possible, in order to lower the costs of the product to an affordable range; this suggests that the elementary school is a better target than the secondary school. Also, teachers have more instructional flexibility in the elementary school and possibly more experience at trying innovations in their teaching than is the case with secondary school teachers; in addition, the younger the child, the higher the pleasure vector will probably be.
- *Give priority to helping teachers with instructional implementation.* Examples, lesson ideas, strategies for student management, and strategies for using the resource in group discussions in the classroom should be essential accompaniments to the electronic book.
- *Design the electronic book and its user interface for group use.* This should not be around the model of the individual sitting alone and for an extended period of time at the computer, but

around the model of a group of children using the resource together for a relatively short amount of time and in the context of other instructional activities. Consider also the likelihood that the teacher will use the book as a resource, for demonstrations for example, and design it for visibility in a large-group setting. This is important both for the user interface and for page display strategies in general.

Unfortunately, until now, educational software designers in general have shown little understanding of the importance of these sorts of recommendations (which are pertinent to many types of educational software and not just to electronic books). The 'inward' focus dominates their design and evaluation approach and the literature about their products. So far, this is also the case with electronic books. Figure 3 shows the prediction of the future of electronic books in the school setting without this focus on teacher instructional support.

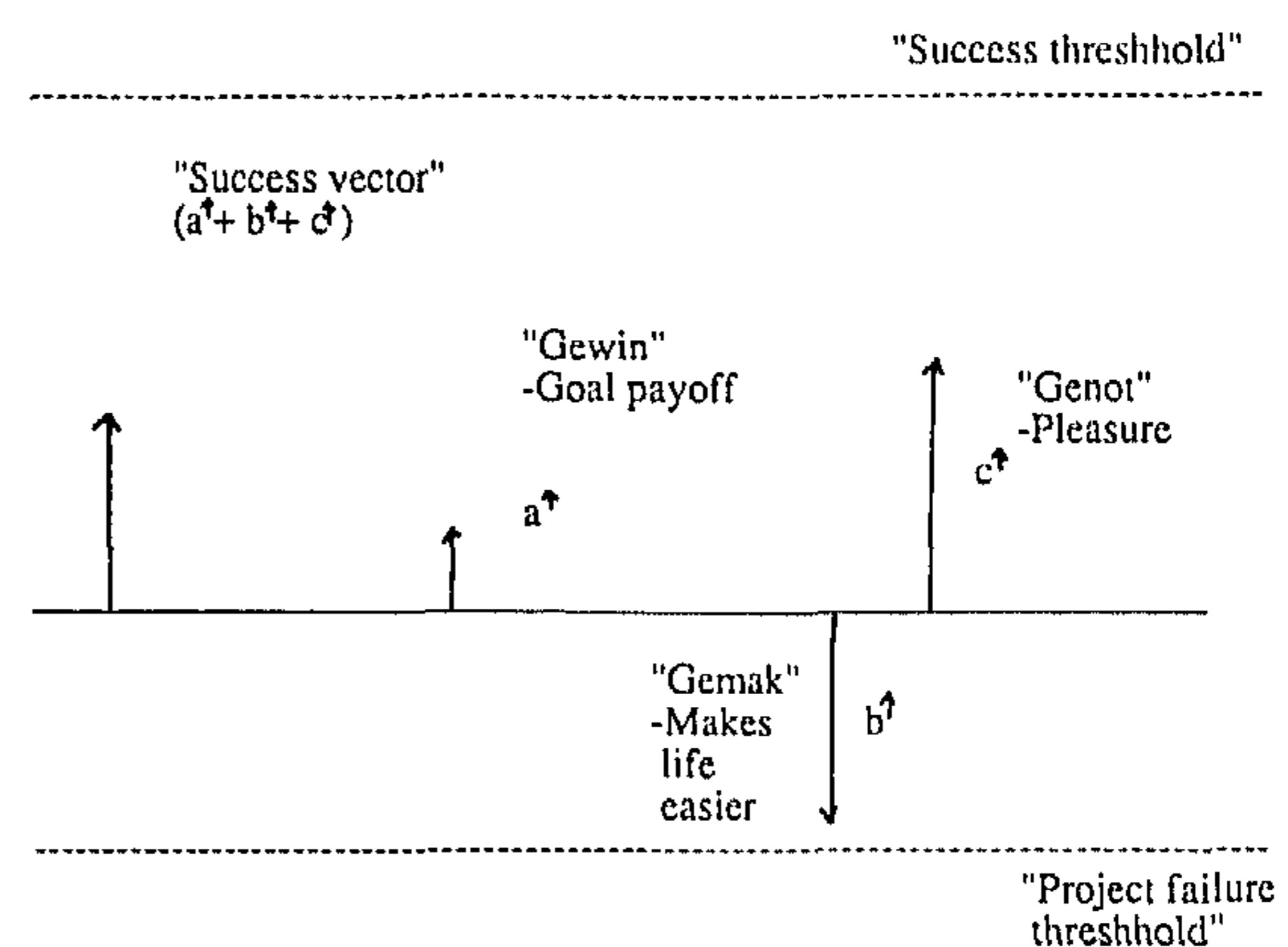


Figure 3. Prediction for electronic books in the school setting, without a teacher support focus.

### University setting predictions

The university setting for electronic books calls for a different interpretation than was the case for schools. A major limitation at the university level is that the textbook model can probably not expect to function, except in the context of individual research projects, because there is no market consistent and big enough to stimulate a publisher to produce this type of resource and hope to recover the costs incurred. Individual research projects have little hope of implementation



beyond their own settings, for a variety of reasons. Therefore, at least in the next five years, it seems that the reference-type model is the only viable large-scale type of electronic book to expect at university settings.

In a university setting, a reference-type electronic book would be used predominantly by individuals for short periods, in the context of their study or research. Thus the instructional/teacher-training emphasis needed for school settings is minimized. 'Making life easier' is more likely to be a positive vector, assuming that students have convenient access to the resources. Network availability may be the stimulus for critical mass usage at the university level. User interface considerations are much more important, both in that users will be likely to be working individually with the resource, and that navigation efficiency will be a prime component both of *gemak* and *gewin*. *Gewin* will be a function of access to resources, navigation efficiency, and also the content of the reference-type book.

Without worthwhile information in the electronic book, the student will not bother to go to it. 'Worthwhile' will be defined differently for different students and disciplines; in some disciplines it will mean up-to-date and extensive information. It will generally have to be the case that what is available from accessing the reference-type electronic book is more useful to students than would be what they would find using their other traditional resources, such as the university library and their conventional textbooks. The ability to add video to a resource collection may be the critical aspect here, to raise the reference-style electronic book above the usefulness of the traditional resources. *Genot* is not likely to be a factor at the university level, although one hopes that intellectual pleasure could escalate from this type of information contact. Cost is a critical issue, because to meet the above requirements of ease of access and added-valueness the university will have to invest in workstations equipped for multimedia, and should invest in supporting the access of the resources also through local area networks. Cost also applies to the construction of the resource itself – whether publishers are willing to invest in an adequate resource. The cost of such a resource means that it has to be broadly based – English literature rather than Jane Austen – which will complicate the indexing and navigation

support. Copyright problems in terms of what can be included in the electronic book will immediately challenge and possibly seriously constrain the depth and value of the resource.

It may be that this sort of electronic book is much more an area for publishers and content specialists now than it is for educational designers; what we can do on our own will not be significant enough in terms of user access and critical volume of information (without copyright problems) to expect 'success'. We can have our contribution with regard to augmenting the electronic book, perhaps with study tools for note taking or concept mapping, and with regard to navigation and user disorientation, but we predict that the major components influencing 'success' are out of our hands and in those of other actors in the implementation scene – educational publishers and those making resource decisions at the university level. Hoekema (1990) describes this dilemma in terms of the 'Treasures of the Smithsonian' project on which he has worked. (Although he does not specifically call his product an electronic book, it can be classified as a reference-type electronic book by the definitions in this article.) After detailing the complicated design process for the product, he now describes himself as in a 'waiting for trial by ordeal' phase, in that 'the real test of our design will be whether consumers . . . will purchase 'Treasures' . . . Of course, the success of this and other programs depends on – even as it helps enable – the success of the CD-I medium as a whole' (p. 22). Figure 4 summarizes our prediction for the university level.

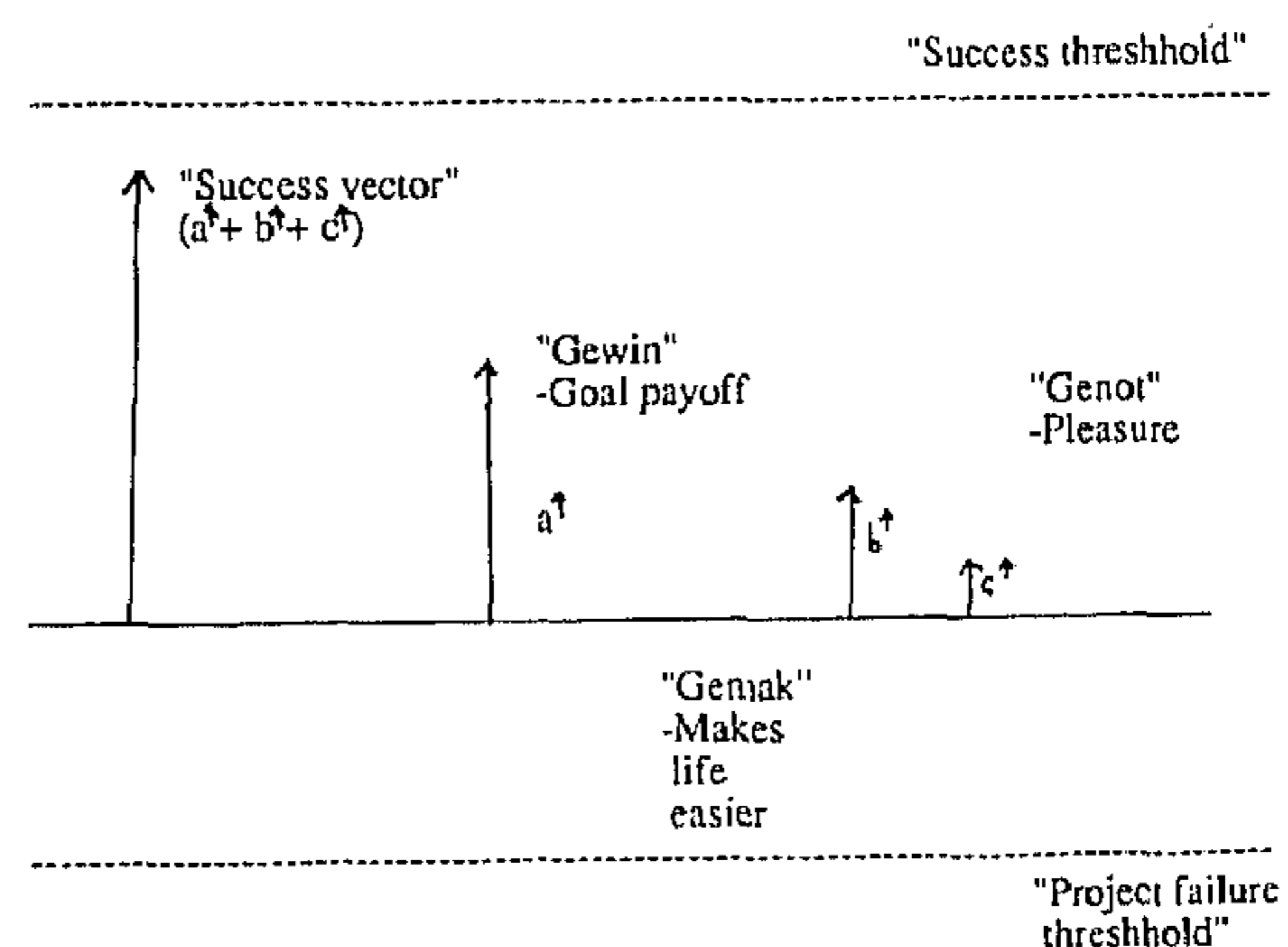


Figure 4. 'Best-Chance' prediction for electronic books in the university setting (based on discipline-wide reference-type multimedia electronic book with LAN access).



## CONCLUSION

So, what is our prediction so far for the future of electronic books? We have used the so-called 3G approach, which we have incorporated into a 'cost-expectation' perspective to make some preliminary predictions about the likelihood that electronic books will move from the research setting and into practice. We have made some suggestions as to the most promising combinations and strategies to increase this likelihood of implementation success. This was only a preliminary exercise as an early test of a framework and approach to evaluating electronic books, reflecting on the question of future resources in educational settings. We have not discussed additional types of setting, such as training centres or settings that may be outside the existing educational institution: for example, Lewis (1991, p.4) speaks about an ITOL model – information technology-based open learning – and Barker and his colleagues are exploring 'portable interactive learning environments' (undated personal correspondence). These open environments may offer better test-beds for electronic books than the inside-the-institution approach we have used here; however, the question of how feasible it is to expect technically supported open learning to supplement or replace existing institutional delivery models such as schools and universities is a question for another paper.

So we have some optimism. But we believe it is critical that this sort of evaluation approach should be a regular part of the formative thinking of designers and researchers in this innovative field. It is perhaps a bad sign that the major part of the literature on electronic books so far reflects and 'inward' orientation; we believe inward evaluation must be responsive to the findings of an 'outwardly'-oriented evaluation, the latter of a type more familiar to marketers and publishers than to cognitive scientists and educational designers. This paper has been an attempt to suggest a preliminary strategy for this sort of 'outward' orientation and for using it as a source of formative evaluation for designers and developers. We hope it stimulates discussion around the question: Is there a future for electronic books? Or will they, as yet another innovation in education, fade away, labelled in the future as a fad, or a noble but unrealistic idea, or foolishness?

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