COSTS & BENEFITS of GUIDED DISCOVERY ARHITECTURE ONLINE PROGRAMS

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ABSTRACT
This paper focuses on the common features of Guided Discovery Architecture (GDA) online programs. It is also about developing a descriptive cost-benefit analysis of online program of GDA. It discusses how the features of GDA instruction differ from those of conventional distance education (DE) courses in terms of not only cost categories associated with online program features but also benefits associated with developing and implementing online programs. This paper addresses on definitions and measurements of expenditures and benefits of development and implementation of online programs.

INTRODUCTION

Recent technological innovations foster a growing popularity of offering online education (Morgan, 2000). As such corporate and academics start to pay attention to cost-related issues that are involved in production and join the bandwagon of promoting electronic instruction; there is a need to call for more information about cost analysis pertinent to developing and implementing online courses.

Paralleling the welcome of online education in educational and corporate settings is a growing interest in literature on incorporating instructional pedagogy in online design to facilitate learning (Milam, 2000). One commonly accepted belief is proposed that problem solving be a significant approach in learning. That is, learning occurs when there are opportunities for learners to use knowledge in solving problems that are embedded in situational contexts (Berryman, 1990; Brown et al., 1989; Savery & Duffy, 1995). The notion of problem solving is applied to online instructional design by integrating learning methods such as simulation, case-based study, and problem-based learning (Clark, 2000). According to Clark, online program design of this kind is called guided discovery architecture (GDA) of instruction.

GDA online programs are evolving into a flourishing stage in association with the use of technology (i.e., synchronous and asynchronous communication tools). Nevertheless, study on features of GDA online programs and systematic examination of cost-related issues remains far away from much. Hence, it would not be inappropriate to focus on features and cost analyses of online programs of this kind.

The purpose of this study is to explore common features of GDA online programs and to develop a descriptive cost-benefit analysis of online program of this kind. Specifically, the following research questions are generated to address the purpose.

- What features specific to GDA instruction can be generalized from current online programs?
- How features of GDA instruction differ from those of conventional DE courses?
- What expenditures does development and implementation of GDA online programs incur?
- What benefits does development and implementation of GDA online programs bring forth?
- How do GDA online programs differ from conventional distance education (DE) courses in terms of cost categories associated with online program features?
- How do GDA online programs differ from conventional DE courses in terms of benefits associated with developing and implementing online programs?

LITERATURE REVIEW

Distance Education

Distance education (DE) has been evolving for at least one hundred and fifty years. It has been serving audiences from all walks of life, taking the form of from correspondence (i.e., newspaper and newsletter) to sophisticated, advanced electronic and satellite technology (i.e., audio recordings, television instruction, videoconferencing, and electronic learning involving the use of computers) (Schlosser and Anderson, 1994). Concerning definition, DE has multiple meanings. To analyze costs and benefits of DE, it is important to know its main features.

According to Molenda (1996), distance education refers to a program of some duration, leading to formal recognition of achievement, in which the learner is separated from the instructor and in which special

arrangements have been made to facilitate dialog between the remote students and an instructor. This definition implies a broader scope of the use of methods and media to carry out DE. In this paper, discussions of DE will be limited to computer-networking instruction, that is, online programs. This is to compare online programs of general DE and those that feature with the guided discovery architecture (GDA) instruction.

Current research does not seem to explicitly define features of general DE instruction. However, reviewing principles of DE online program design enables to conclude what an ideal DE online program will be. For example, Florida Gulf Coast University (2002) proposes a set of principles for designing online instructional materials as a reference for its faculty. Main features of an ideal DE online program can be inferred from these principles.

- *Learner Centeredness*

Due to the geographical separation between instructor and learner, the notion of leaner centeredness is strongly promoted as one feature of online program instructional design. Learners are assumed to take the initiative in and be autonomous in learning. In addition, learner-centeredness is by the provision of instructional content that are organized and selected based on learner's perceptions and needs.

- *Instructional content is structured and sequenced as integral to achieving goals and objectives of learning*

In addition to explicit goals and objectives of instruction, information is chunked to help learners learn the content. Under the circumstance when F2F communication between instructor and learner is not convenient, structuring and sequencing content plays a role in guiding learners in self-study and to achieve the instructional goals and objectives. Activities are developed to facilitate in achieving instructional goals and objectives.

- *Boundaries of time and space are being eliminated*

With the use of synchronous and asynchronous tools on the Internet, DE online programs provide flexibility for learners in space and time.

- *Instructor facilitating in learning*

To foster the notion of learner-centeredness in online instruction, an instructor develops activities to encourage self-directed study as well as frequent and meaningful interactions among learners and between learners and instructors.

- *Interaction*

Fostering interaction between instructor and learner as well as among learners is commonly regarded as a significant element for DE online instruction. To this end, instructional pedagogies play a vital role for quality interaction including the provision of timely and constructive feedback from instructor and learner.

- *Diverse ways of learning assessment*

To ensure effective learning in DE online format, it is suggested that differing ways of learning progress assessment be employed, such as exams, homework, research reports, journals, and portfolios as well as case studies and solving problems.

- *Use of synchronous and asynchronous communication tools for instruction delivery and promotion of interaction*

A synchronous communication mode includes chat, video-conferencing, and telephone, while an asynchronous mode involves the use of electronic mail and bulletin board. Either mode of communication is intended to facilitate online instruction delivery and interaction.

- *Electronic collaboration*

Collaboration among learners is encouraged in online learning through the design and the selection of collaborative learning activities with the use of synchronous and asynchronous tools.

- *Support of relevant resources for learning*

Learners have electronic access to relevant learning resources to facilitate learning.

The features inferred from the principles for general DE online design help providing a bird-eye view of what cost and benefit categories are associated with the development and implementation of DE online programs. Discussions of cost and benefit categories for online instruction will be displayed in the following sections.

Guided Discovery Architecture (GDA) Online Instruction

GDA instruction was first proposed by Clark (1998) as one of the four strategies of instruction that were developed to meet human cognitive and performance task needs. GDA is founded on the constructivist learning theories, which emphasize that learners play a central role in learning, and that they are active constructors of knowledge. The role of instruction is to provide resources and experiences that promote the internal construction of new knowledge and skills (Clark, 1998, 2000). Within the GDA instruction, learners are engaged in solving problems embedded in situational contexts which often feature the use of simulation devices to allow for learners' manipulation (Merrill, 2000). Instructor, who has pre-defined learning goals, set of tasks, topics, and resources, provides guidance and feedback to help learners reason out the problems (Lefrere, 1997).

According to Schank and Cleary (1994), there are five main architectures that can be categorized for guided discovery online learning. The five architectures are 1) case-based learning, 2) incidental learning, 3) learning by exploring/conversing, 4) learning by reflection, and 5) simulation-based learning.

Case-Based Learning: Stories or cases that contain the information or circumstances are used in case-based learning. Students must examine the cases and to make decisions based on their knowledge of the content area (Schank & Cleary, 1994).

Incidental Learning: In incidental learning, instructor creates tasks involving a fun way for students to learn boring things. Those tasks enable students to remember those boring concepts when they become necessary in some contexts (Schank & Cleary, 1994; Bicknell-Holmes & Hoffman, 2000).

Learning by Exploring/Conversing: This type of discovery learning is based on an organized collection of answers to questions individuals can ask about a particular topic or skill (Schank & Cleary, 1994). In this architecture curiosity has an important role in motivation since students use it as a tool for solving a given problem by only asking questions.

Learning by Reflection: In learning by reflection, students learn to apply higher-level cognitive skills by using an interrogative approach and reflecting on what they know in comparison to the qualities they are examining (Schank & Cleary, 1994).

Simulation-Based Learning: Students are given an artificial environment that allows for the opportunity to develop and practice a complex set of skills or to witness the application of abstract concepts (Bicknell-Holmes & Hoffman, 2000).

As mentioned, GDA instruction includes different types of architectures, which require employing advanced technology for online delivery. Business and industry, for instance, has applied the GDA instruction through case-based learning. In addition to sharing the features that are common to general DE online courses, a GDA online program includes the following specific features (Savery & Duffy, 1995; Clark, 1998, 2000):

- *Highly self-directed and constructive form of learning*

Within the GDA instruction, learners are encouraged to work on assignments self-directed, or at their own pace. That is, learners can take their time participating in making decisions about what, how, and when something is to be learned and even play a major role in making such decisions.

- *Engaging learners in realistic problem-solving tasks*

Based on its constructivist perspectives of learning, GDA instruction stresses that knowledge transfer or learning occurs when learners are provided with opportunities to apply instructional information to authentic contexts and conduct high-level thinking in problem solving.

- *Use of simulation to enhance problem-solving learning*

To create a realistic problem-solving environment, GDA instruction also features utilizing simulations, 3-D environments, or various kinds of multimedia. Thus, simulations allow participants to make mistakes and learn from their successes and failures in a safe, but yet realistic or semi-realistic learning environment.

Cost-Benefit Analysis

Cost-benefit analysis (CBA) refers to the evaluation of an action according to its costs and benefits in terms of monetary values (Levin & McEwan, 2000). As its name suggests, CBA is used to assess whether benefits of implementing an action outweighs expenditures incurred in the action, that is, to see if there is a high ratio of benefits to costs. To use this method, benefits and costs have to be expressed in financial values. This implies an

obvious disadvantage of using the CBA method because often are benefits not tangible and thus, are difficult to be converted to pecuniary values.

Measuring Costs of Online Programs

Development and implementation of online programs is a complex task. It takes upon a tremendous amount of time and energy and involves supports of personnel, professionals, and technology. As a result, calculating expenditures incurred in an online program can be a daunting challenge. The nature of complexity of measuring costs implies a need to generate guidelines to as well as categories for conducting cost analysis of online course development and implementation. Milam (2000) emphasizes that in order to be able to make informed decisions, the costs of online programs ought to be understood and measured. Forming of guidelines and general categories is indeed a fundamental step for measuring costs and planning development and implementation of online programs.

Despite the nature of complexity that tabulating costs of online programs features, it is fortunate to see that recently consensus is being shaped from research on categories and variables for measuring costs of online programs. For example, Milam (2000) and Morgan (2000) respectively published papers on cost categories involved in distance and online education as well as formulas and guidelines on measuring online costs. Alfred P. Sloan Foundation (2001) commissioned six universities to conduct analyses of cost and potential profitability of online education. Penn State University (Miller, 2001) conducted a study on cost effectiveness and efficiency of its online programs (i.e., World Campus). Summary of categories for and guidelines on determining online costs from the research can be made as follows.

Notice that measuring online net costs is achieved by subtracting revenues from actual expenses. Hence, two groups of pecuniary categories are taken into accounts. One group is the categories of expenses; the other is the group of revenue. Generally, there are seven categories to consider expenses.

- *Technology*

An institution needs to build a proper technology infrastructure to support online courses. In addition to computers along with accessories and facilities, infrastructure includes a server, software, software delivery tools, and bandwidth. It is suggested by Morgan (2000) that infrastructure costs should be amortized over a three-year period (which is the average lifespan of the infrastructure of many computer systems).

- *Support personnel*

Operating online programs requires an individual (i.e., in Morgan's (2000) term, "a business manager") who is in charge of managing online courses. Responsibilities of a business manager includes 1) administering evaluations on the technology being used in delivering online courses, 2) coordinating faculty working with online courses and supporting personnel and 3) providing faculty and students with instructional technology, design and technical support.

- *Faculty development*

To facilitate online teaching, faculty needs training on using technology. When necessary, expenses need to be spent as incentives to attract faculty to attend training.

- *Hidden costs*

Hidden costs, which are also called overhead or indirect costs, refer to expenditures not directly attributable to online course development and implementation. Overhead costs can be tabulated from the department level to the institution-wide level and includes building/facility (e.g., heating, lighting, and faculty office space), equipment (e.g., telephone services), services (e.g., handling registration and records, and human resources), computing support services (e.g., technology maintenance and website construction), library support, and help desk support (e.g., student services and learning services).

- *Developing online courses*

Online course development is usually tallied by hours spent. Factors influencing development of online courses include availability of developers, resources available to the developers, technical abilities to deliver courses (i.e., synchronous or asynchronous tools), availability of content for online courses, pedagogical knowledge, types of instructional strategies and methods, and programming needs.

Cost varies depending on developing factors. Milam (2000) suggests that faculty and staff are good sources for depicting factors influencing online course development. Interviews can be conducted to instructors to detect teaching processes, faculty's roles as well as time spent in course preparation.

On the other hand, the nature of course content plays a partial role in determining costs. For example, when one course is didactic-oriented, a design of low interaction between instructor and learner suffices the delivery of the course, which in turn requires less sophisticated programming and thus, costs less.

- *Teaching online courses*

Online teaching can be labor intensive because of the use of technology. Hence, money needs to be proportioned to faculty compensation as necessary. Compensation includes salary and/or benefits, and is given in one of the following ways: 1) a flat stipend per course, 2) stipend per student enrolled, and 3) as part of a faculty's regular pay.

- *Other direct costs*

One direct cost factor is staff support for online course development and implementation. For example, expenditures for student wage employees developing applications such as Java simulations. Another apparent direct cost is marketing, which includes inquiry database management, publications, client development and advertising for online programs.

To determine costs for online education, it is necessary to calculate revenue. Revenue can be estimated by looking at the following factors:

- *Student enrollment*
- *Courses offered*
- *Student number per class*
- *Students' tuition (*Net tuition profits need to minus waivers, financial aids, and tuition discounting*.)*
- *Technology fees*

Measuring Benefits of Online Programs

Valuation of benefits is often subjective and reflects preferences of choices that have been made in respect to an action by an institution (Watkins, 2001). Consequently, there seems to be little agreement in the literature on how to define benefits within cost-benefit analysis for distance education programs. Cukier (1997), however, identified three benefit categories. Examples given in his article were made from standpoints of user, instructor, and department/institution.

- *Performance-driven benefits*

These benefits include factors such as revenues (e.g., student tuition, technology fees), budget earmarked on development and implementation of online programs, learning outcomes, student and teacher satisfaction, and opportunity cost (e.g., time saving).

- *Value-driven benefits*

Benefits in this category include flexibility, access, interaction, and adaptability of materials. For instance, use of technology allowing for flexibility to learners, a wider access for the public to education, "real-time" communication when learners are geographically separated from one another, and quality of instruction delivery. In addition, the rate and ease by which instructional materials being updated and changed and the increase of opportunities for residential students to produce online courses while employing relevant theoretical models.

- *Value-added benefits*

These refer to incidental, indirect benefits such as reduction in capital investment (e.g., few buildings and parking lots may be required), reduction in pollution, increased job creating, new business opportunities (e.g., telephone companies and publishers), reduction in social community costs (as a result of better trained individuals), and the creation of secondary markets (e.g., software companies).

METHODOLOGY

Cost benefit analysis of online programs featuring the GDA instruction was conducted for this study. In particular, the purpose of this cost-benefit analysis is two-faceted. One is to generalize common features of GDA through examining current online programs in preparation for identifying concurrent cost and benefit categories. The other purpose is to conduct comparisons of features and corresponding cost and benefit categories between GDA and conventional DE programs.

Data Collection

Qualitative research technique for data collection was employed. Interview and research review were the main methods for this regard. Interview questions were developed to elicit information about GDA features and costs as well as profits associated with the development and implementation of the online programs of this kind. These questions intended to seek for four groups of information. One was the theoretical background(s) behind and approaches employed in a GDA online program. Second was to identify design features of a GDA online program. The third question was to identify cost categories associated with design features and actual expenditures. The last question was to identify benefits associated with the development and implementation of a GDA online program.

Interviews were conducted with three directors of three online programs/projects (Quest Atlantis, Learning to Teach with Technology Studio, Online Case Studies at Kelly Business School) at a large Midwestern university of US. In addition to interview, content analysis methodology was employed to generate features of conventional DE programs and categories of cost and benefit related to developing and implementing DE courses.

COMPARISON of FEATURES and COSTS/BENEFITS BETWEEN DE & GDA

Features and categories of costs and benefits associated with the development and implementation of conventional DE courses and GDA programs are generated through research documentation and interview. Comparisons are made into the following tables.

Table-1: Comparisons of Features between DE and GDA Online Programs

DE online programs		**GDA online programs**	
Features	**Feature details**	**Features**	**Feature details**
Learner-centered learning	• Use of asynchronous and synchronous communication tools • Flexible access to learning website • Meet learners' perceptions and needs	Learner-centered learning	• Use of asynchronous and synchronous communication tools • Flexible access to learning website • Meet learners' perceptions and needs
Interaction	• Use telecommu-nication tools • Provision of feedback from instructor, peer, material, and help desk	Self-paced, self-directed learning	• Use of asynchronous and synchronous communication tools • Flexible access to learning website
Incorporating instructional media	• Use of multimedia (e.g., audio and video) • Information presentation • Interface design	Interaction	• Use of asynchronous and synchronous communication tools • Provision of feedback from instructor, peer, material, and help desk
Structured course content	• Instruction is sequenced and grouped	Incorporating instructional media, with relative high percents of the use of simulation and animation in 3-D learning environments as well as the use of asynchronous and synchronous tools.	• Use of multimedia and advanced technology • Information presentation • Interface design
Instructor facilitating	• Use of asynchronous and synchronous communication tools • Provision of relevant resources • Provision of timely feedback and help	Structured course content	• Instruction is sequenced and grouped

Assessment	• Self-, peer-, and instructor- evaluation • Giving practice tests or evaluating performance	Engaging students in problem-solving contexts	• Use of simulations • 3-D environment • Use of multimedia (e.g., audio and video)
Accessibility to resources	• Creating a database of resources (e.g., help desk, FAQs, tutorials, and workshops) • Selecting appropriate resources and updating Transparent and user-friendly design	Exposing students to authentic problems, scenarios, stories, and cases	• Generating of appropriate problems, cases, and resources • Structuring instruction, concepts, sub-concepts
Elimination of the boundaries of time and space	• Use of synchronous and asynchronous communication tools	Instructor facilitating	• Use of asynchronous and synchronous communication tools • Provision of relevant resources • Provision of timely feedback and help
Collaborative learning	• Use of synchronous and asynchronous communication tools • Interaction between learners and learners	Assessment	• Self-, peer-, and instructor- evaluation • Differing assessment techniques
		Accessibility to resources	• Creating a database of resources (e.g., help desk, FAQs, tutorials, and workshops) • Selecting appropriate resources and updating Transparent and user-friendly design
		Elimination of the boundaries of time and space	• Use of synchronous and asynchronous communication tools
		Collaborative learning	• Use of synchronous and asynchronous communication tools

Notes:
1. The "features" specific to GDA online programs, which are highlighted or emboldened, are generated from interviews with people involved in developing online programs of this kind.
2. The "feature details" for both DE and GDA online programs are developed based on research documentation and elaboration of the generated "features."

As Table-1 shows, GDA online programs and conventional DE courses share most of the features listed. The highlighted specific features such as self-paced learning have high percents of the use of simulation and animation in 3-D learning environments as well as of the use of asynchronous and synchronous tools to engage students in problem-solving contexts and authentic problems, scenarios, stories or cases.

This study is conducted based on three online programs/projects mentioned previously. The features of those online programs are as follows: In LTTS website, problems are presented and structured as instructional modules that are designed for target audience (i.e., pre-service teachers) to learn to teach with the use of technology. The context, in which problems are authentic, is familiar to the audience. The website provides updated electronic resources to guide learners in accomplishing assignments. In addition, design of a discussion forum and messenger not only creates flexibility for learners in communication but also facilitates collaborative learning. The database system(s) for learning encourage(s) a self-directed learning style.

The Quest Atlantis project features an online simulative meta-game environment where "players" take upon roles to solve problems. This simulative environment creates a challenging atmosphere for problem solving. It also engages "players" in abundant social interactions with peers.

In the case-study project(s) of Kelly Business School, cases are developed in story or scenario format and the information included in those stories or scenarios are used by learners to interpret and make decisions. These cases particularly have a business-discipline focus, and vary from simple (e.g., 5 pages of content) to complex (e.g., 20-30 pages of content). Learners can select cases based on time available whenever they log in on the project websites.

Table-2: Comparisons of Cost/Benefit Categories between DE and GDA Online Programs

COST CATEGORIES	BENEFIT CATEGORIES
Technology • Set-up of appropriate infrastructure supports the operation of GDA online programs. • Creating database systems is indispensable for facilitating information processing and interactivity among instructor, learner, material, and interface design. • Programming is significant for creating an interactive environment in which the features can be realized. • Support personnel provide instructional technology support to faculty and technical. • Support to students, carry out faculty and teacher associate training, install software, and set up and maintain proper technical environment. This could also include graduate student assistants who are hired or work voluntarily for technological set-up and support. **Developing online course** • Teaching compensation for development of course materials. Course development takes a tremendous amount of time in structuring instruction, selecting, generating, and updating appropriate problems, cases, and resources. • The need to recruit web-designer(s), interface-designer(s), and media producer(s) to assist in producing online courses. • The positions of a teacher liaison and a project manager serve to coordinate online course and project management or to take in charge of program marketing. **Teaching online courses** • Hiring instructors to teach online. • Hiring teacher associates serving as "24 hours-a-day-7 days-a-week" assistants to provide feedback to learners. **Implementation** • Technology—equipment and facilities updating and upgrading, technology support and maintenance personnel • Course development—course material updating.	Benefits are considered from the perspectives of learner, instructor, and the department/institution that implements and sponsors the development of online programs. **Learner** • Given flexibility in learning (i.e., having access to schooling at a minimum cost of sacrificing jobs or rearranging life style, completing assignment and earning a degree anytime, anywhere). • Saving time and energy from commuting between home and school. • An increase of employability in job market. • Elevation of knowledge horizon • Given quality learning regardless of geographical distance (i.e., experiencing "real-time" communication and gaining and providing feedback to one another, and having electronic access to library resources) • Given respect for different learning styles with options for learning assessment being available. • Facilitated in learning transfer by being given opportunities to apply instructional information to authentic contexts that feature a 3-D learning environment, a use of simulation case, and a problem-based learning strategy. • Improving abilities to use inert knowledge. • Fostering high-level thinking through recall, comprehension, application, analysis, synthesis, and/or evaluation of instruction. • Motivated to learn by encountering and engaging actively in authentic cases, problems, and contexts that are relevant to learners' real life backgrounds. • Motivated to learn with the use of media of fidelity to present tasks and carry out assessment. • Developing responsibilities of learning and a sense of achievement in the learning process. • Gaining opportunities to solve problems collaboratively with the use of synchronous and synchronous communication tools. • Increasing technology competence. **Instructor**

Indirect cost categories • Teaching—office space, administrative overheads, and help desk support. • Course development—supplied consumed. Implementation— administrative overheads and library resource support.	• Given flexibility in instructing and providing feedback. • Use of technology allowing for ease by which instructional materials are updated and changed. • Increasing technology competence. • Improving instructors' application and understanding of theoretical methodology behind the GDA instruction through hands-on online course design. **Institution (Department)** • Revenue generated from tuition, technology fees, and earmarked budget. • Heightened Institutional (departmental) reputation • Increased student diversity • Providing an option to residential students for learning. • Offering on-site students opportunities to assist in developing authentic GDA online instruction by applying the knowledge and skills learned. • Providing opportunities for departmental faculty and students to conduct research that may lead to publication of GDA instruction.

Notes:
1. Cost and benefit categories are generated based on the interpretation of research review and interview data.
2. Cost and benefit categories that are specific to GDA online programs are highlighted in gray background.

To discuss costs and benefits associated with the development or implementation of online programs, five categories are identified for cost analysis (i.e., technology, developing online courses, teaching online courses, implementation, and indirect costs), while three benefit categories proposed by Cukier (1997) are employed in terms of three perspectives of beneficiary (i.e., learner, instructor, and the department/institution that implements and sponsors the development of online programs). Like the comparison of features between GDA online programs and DE conventional courses, GDA instruction shares most of the cost and benefit categories associated with the development and implementation of the DE courses. Nonetheless, there are some categories attributed to developing and implementing the features that are specific to GDA online programs.

For cost category, it is inferred that expenditures be spent in developing GDA online courses. The significance of this category is explicable. To ensure that a GDA online program engages learners in solving authentic cases and problems and allows for convenient access to electronic relevant resources, instructors are required to spend time in generating and updating appropriate cases, problems, and resources. Notice that in this study cost categories for teaching online courses, implementation, and indirect costs are generated entirely based on research review. The interview data available were not able to provide information about teaching and implementation of GDA online programs. As a result, indirect costs related to teaching and implementing the programs are lacking. Moreover, my inference regarding high costs incurred in developing GDA online courses can be proved by outlays in the interviews (see Appendix and Table-3).

For benefit category, it should be noted that categories are generated mainly from the interpretation and elaboration of the GDA and DE features and application of research review. Interview questions did not elicit much input from the interviewees for this regard. From a learner's perspective, GDA online instruction includes a variety of unique benefits from those for conventional DE courses:

- Facilitating knowledge transfer
- Improving abilities to use inert knowledge
- Fostering high-level thinking
- Motivating learning by encountering learners and actively engaging them in relevant problem-solving tasks
- Motivating learning with the use of media of fidelity to present tasks and carry out assessment.
- Cultivating learners' responsibilities of learning and a sense of achievement in the learning process.

- Providing opportunities to solve problems collaboratively with the use of synchronous and synchronous communication tools.

From an instructor's standpoint, instructors' application and understanding of theoretical methodology behind the GDA instruction can be improved through hands-on online course development and teaching. Developing and/or implementing GDA online programs provide opportunities for faculty and students to conduct research that may lead to publication of GDA instruction.

The following table displays costs that are actually incurred in developing GDA online programs. The cost information was acquired through the three interviews.

Table-3: Examples of Expenditures Incurred in Developing GDA Online Programs

	LTTS (problem-based learning)	**Quest Atlantis (role-play, simulation)**	**Online Case Studies (case study, problem-solving)**
Technology	• 2 servers: $1500x2= $ 3,000 • Staff computers: $ 4,000	• Activating engine -- $ 10,000	• No specific cost information about technology. They use the current technology on university campus, intending to save costs. As a result, this aspect of costs can be categorized as "indirect costs" in this case. • As pointed out by the director, costs might be charged for bandwidth and equipment.
Subtotal	$ 7,000	| $ 10,000	
Percentage	7,000/830,000= 0.8%	10,000/90,000= 11.1%	
Developing online courses	• Instructional development (K-12 teachers serve both as instructional designers and SMEs): $ 150,000 • Teacher liaison: $ 15,000 • Video production (36 video clips for 12 modules): $ 200,000 • Interface design: $ 125,000 • Programming: $ 100,000 • Web developing: $ 80,000	• Content experts (Graduate students) – $ 50,000 • Graphics – $ 8,000 • Programming -- $ 15,000	• Design and development -- $ 10,000, with half of the budget for either task. • No compensation was earmarked for the hours faculty spent in working together with designers. • An expenditure estimate was made for faculty compensation was $ 6,000 to $ 10,000 • Programming— no information provided, but an estimate of $250,000 to $ 500,000 for two programmers working 20,000 -- 40,000 hrs to build and implement an online program was made.
Subtotal	$ 670,000	$ 73,000	$ 266,000 – $ 520,000
Percentage	670,000/830,000= 81%	73,000/90,000= 81.1%	266,000/266,000= 100% 520,000/520,000= 100%

Teaching online courses			
Subtotal			
Implementation	• Marketing: $ 3,000 • Project managing: $ 150,000	• Marketing: $ 5,000 • Trading cards for motivating kids -- $ 2,000	
Subtotal	$ 153,000	$ 7,000	
Percentage	153,000/830,000= 18.4%	7,000/90,000= 7.8%	
Indirect costs			
Subtotal			
Total	**$ 830,000**	**$ 90,000**	**$ 266,000 - $ 520,000**
Total percentage	**100.2%**	**99.9%**	**100%**

Notes:
1. Expenditures incurred in LTTS were calculated based on 3-year duration of its development, while costs for Quest Atlantis were tabulated in a six-month time period.
2. There was no specification of the duration for the development of the case-based online project(s).
3. Both the LTTS and Quest Atlantis projects were at an early stage of implementation. Therefore, no information about costs regarding teaching and indirect charges was available. This was also true in Online Case Studies.

Comparisons of expenditures will be made between conventional DE courses and authentic GDA online programs (i.e., the projects that were referred to in the interviews). For GDA online programs, the table above shows that percents of costs spent in course development are high for both the LTTS and Quest Atlantis projects, compared to expenditures incurred in technology and implementation as well as other cost categories (See Appendix). It is interesting and beyond expectation to see that in all the projects that the three interviewees referred to in their interviews technology does not account for a high percent of total expenditures incurred in developing and implementing the projects. As the three interviewees mentioned, they tried to spare money by either making the use of the facilities and equipment available on the campus or aligning online design to local academic standards (i.e., the Quest Atlantis project). In the case of the LTTS project, only 7,000 dollars were spent in the purchase of servers and staff computers. For Online Case Studies Project, costs for technology were even considered as overheads, and were not tabulated directly. It thus can be inferred that technology for computer-based communication are relatively advanced on the university campus. When it comes to developing and/or implementing GDA online programs, costs spent in the technology infrastructure building can be transferred to indirect categories.

Comparatively, research on costs incurred in developing and implementing conventional DE courses tells a somewhat different story. In the article by Carr (2001), one example demonstrated how money was consumed in terms of cost categories. Researchers at the University of Maryland's University College found out that over $334,000 that was spent over twenty-two months to offer its online M.B.A. program to thirty students can be broken down into the following main categories: 31% for faculty salary, 10% for course development, 28% for implementation (which included 4% for web administration, 12% for IT help desk, and 12% for program coordinating), 15% for marketing, and 16% for administration overheads and others. There was no information as to how long the M.B.A. program was being developed and implemented, though.

Apparently, the percentage of costs spent in course development is surprisingly low, compared to that in developing GDA online instruction that featured engaging learners in problem-solving tasks and simulating and even animating environments. On the other hand, the study revealed that costs and faculty compensation are continuous and outlays as long as a DE program is implemented to offer courses to distance learners. This will hold true for implementing GDA online programs as well.

High percentage of costs spent in developing GDA online programs is in accordance with time (which is measured by hour) spent in structuring instructional content, generating and updating appropriate problems, cases, and electronic resources, and selecting pedagogies to enhance effective learning. Course development

alone consumes a high amount of money. All the projects discussed were at their early stage of implementation; not much information on costs incurred in teaching online courses and implementing the projects as well as on corresponding indirect charges has been generated.

As for the benefits associated with developing and implementing the GDA online programs (i.e., the projects that were referred to in the three interviews), estimating profits was difficult for the following reasons. First, by nature most of the benefit categories listed in research review and the table above cannot be converted to monetary values. Secondly, due to the prior reason, it was a daunting task for the interviewees to assign monetary values to intangible benefit variables. While benefits of some categories can be traced simply by calculating revenues such as the number of student enrollment, student tuition, technology fees, or budget earmarked for specific purposes, computation of most of the benefit categories might involve the use of sophisticated statistical formula and collection of numerous relevant indirect charges.

CONCLUSION

A high level of overlapping features is found for conventional DE courses and GDA online programs. However, based on interviews, it can be concluded that GDA programs stand out with the features such as encouraging a self-directed and constructive form of learning, engaging learners in realistic problem-solving tasks and authentic learning environments, and using simulation to enhance problem-solving learning.

Like features, cost and benefit categories associated with GDA online programs are similar in a relatively high extent to which those associated with DE courses. Nonetheless, GDA instruction is unique in that expenses are spent in course development since GDA features engaging learners in solving authentic problems, generating appropriate cases, scenarios, and resources, and making the use of multimedia to develop proper learning environments. Concerning benefit, GDA programs bring forth several benefits from the standpoint of learner, for example, facilitating transfer of inert knowledge through applying information to authentic tasks in situational contexts, motivating learning with the use of media of fidelity to present tasks, and encouraging collaborative work in the problem-solving process.

There is a disparity of cost categories and incurred outlays between GDA online programs and DE courses. Concerning cost, the research show that costs incurred in GDA online course development accounts for a relatively high percent of total expenditures, which span over categories such as technology, course teaching, implementation, and overheads in addition to course development. In contrast, research review indicates that in DE courses, two main cost categories are instructor compensation (31%) and program implementation (28%). It can be inferred that this disparity of cost categories and incurred outlays lies in different stages at which the investigated GDA and DE online programs are. As for benefit, in addition to sharing the benefits that conventional DE courses bring forth, GDA online programs highlight some unique benefit categories that are associated with and specific to features of GDA programs. However, benefits, whether general or specific, are not easy to be expressed in pecuniary values.

From this study, it proves that developing and implementing GDA online programs takes a huge amount of time and energy (effort and money). On the other hand, benefits brought forth through GDA program development and implementation can be invaluable. “GDA” or “Not GDA” does not seem to be determined simply by weighing benefits and costs alone. Administrative needs to conduct analysis to clarify whether there is a need for GDA instruction, how such an online program will be fulfilled, and so forth. Apparently, more research with respect to cost and benefit can help in decision-making.

RECOMMENDATIONS FOR FUTURE RESEARCH

In this study, access to resources of real life GDA online programs plays a crucial role in GDA program feature generalization. It is necessary to explore and analyze more authentic online projects that enable to elicit information in this regard. In addition, features of conventional DE courses and concurrent cost/ benefit categories were developed entirely based on research documentation. To do comparisons between GDA online programs and conventional DE courses, paralleling methods of gathering information fosters the reliability of the study. That is, it is indispensable to conduct more case studies of conventional DE programs to explore features and authentic cost and benefit information.

Continuing comparisons between GDA online programs and DE courses, the study can be expanded through answering the following research questions. Since benefits can be significant incentives for developing and implementing GDA programs or DE courses, it will be of help to investigate the followings:

1. How can benefits of either GDA online programs or DE courses be measured in a tangible way? Are there examples of tabulating benefits?

2. Do learners benefit from a GDA online instructional environment?
3. How do features unique to GDA or DE instruction affect expenses categories associated with developing and implementing these features?

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APPENDIX – EXPENSES on CATEGORIES in ONLINE PROGRAMS (LTTS-QUEST ATLANTIS)