An Evaluation Model of Integrating Emerging Technology into Formal Curriculum

Lung-Hsing Kuo, Huei-Mei Wei, Li-Min Chen, Ming-Chen Wang, Miao-Kuei Ho, Hung-Jen Yang

Abstract— The purpose of this study was to identify a formal evaluation model for effects of integrating emerging technology into standard based curriculum. For coping with new contents brought by fast advancing technology, education system should provide ways to integrating those new information of emerging technology into our curriculum for preparing students with up-to-date knowledge. There is a need to find out how to establish an evaluation system for effects of integrating emerging technology into formal curriculum. Several evaluation models were reviewed and compared. Upon the evaluation characteristics, a systematic approach was applied for designing evaluating standards for the context, input, process, and output. A model with fourteen stages was proposed and conducted for research purpose. The experience of creating evaluation system for high scope curriculum innovation was described for supporting the proposed model. The evaluation target was first identified based on the evaluation project, high scope curriculum development. Evaluating items of each category were also identified.

Keywords—High Scope Curriculum Development, Senior High, Emerging Technology, Evaluation System

I. INTRODUCTION

Technology education is a subject area of common education and provides learner the opportunity of accepting technology. Innovative technology grows everyday and the information and knowledge of technology expands, too. Systems of technology in some areas are even exploded, such as energy & power technology and information & communication technology. In science education, how to integrating emerging technology into formal education becomes a concern. Education reform acts in Taiwan pointed out this trend and raised a "High Scope Curriculum Development" project to foster teachers to design teaching material and learning activities of emerging technology.

Evaluation is a mean for understanding how things going. Based on the evaluation goal, criteria should be identified before evaluation could be conducted. There is a need to create a system to pin point effects of integrating emerging technology into formal technology education, so can reveal the integral information and characteristics of curriculum innovation.

II. PROBLEM FORMULATION

Evaluation is an integral part of instructional design. Formative evaluation, specifically, is a phase identified in many instructional design models and should be recognized as an important step for program improvement and acceptance. Although evaluation has many models and approaches, very few deal specifically with formative evaluation.

Further, no one set of guidelines has been found that provides a comprehensive set of procedures for planning and implementing an evaluation of integrating new content into formal curriculum.

A. Technology Education

Technology education is a subject of studying technology in which learners could learn about the context, process, and knowledge related to technology[1]. Technology education is all about learning technology literacy.

Through technology, people have changed the world. In the drive to satisfy needs and wants, people have developed and improved ways to communicate, travel, build structures, make products, cure disease, and provide food. This has created a world of technological products and machines, roadways and buildings, and data and global communications. It has created a complex world of constant change.

Technological literacy is much more than just knowledge about computers and their application. It involves a vision where each citizen has a degree of knowledge about the nature, behavior, power, and consequences of technology from a broad perspective. Inherently, it involves educational programs where learners become engaged in critical thinking as they design and develop products, systems, and environments to solve practical problems.

The acceleration of technological change, and the greater potential and power that it brings, inspires and thrills some people, but confuses—even alienates—others. Many people

L.H. Kuo is with the National Kaohsiung Normal University, 80201 Taiwan, R.O.C. (e-mail:admi@nknucc.nknu.edu.tw)

H.M. Wei is with the National Kaohsiung Normal University, 80201 Taiwan, R.O.C. (e-mail: gracewei@nknucc.nknu.edu.tw).

L.M. Chen is with the National Kaohsiung Normal University, 80201 Taiwan, R.O.C. (e-mail: chenlm7@gmail.com).

M.C. Wang is the principle of Pingtung County Fang Liao High School, 940 Taiwan, R.O.C. (e-mail: micheng.wang@gmail.com)

M.K. Ho is with the C.F. Elementary School in Kaohsiung, 820 Taiwan, R.O.C. (e-mail: hmq0402@gmail.com)

H.J. Yang is with the National Kaohsiung Normal University, 80201 Taiwan, R.O.C. (e-mail: hjyang@nknucc.nknu.edu.tw, phone: 886-7-7172930 ext. 7603,; fax: 886-7-6051206).

embrace technological change, believing that through technology their lives will be made easier. They see the growing ability to solve age-old problems ranging from food supply to education and pollution. Each technological advance builds on prior developments. Each advance leads to additional potentials, problems, and more advances in an accelerating spiral of development and complexity.

A rationale and structure for the study of technology has been presented here that should assure that everyone can gain the foundation they need to participate in and adapt to today's ever-changing technological world. These materials should be compatible with the emerging standards for technology education. It is hoped that this will encourage technology education leaders to develop new curriculum materials at the state and local levels.

Technology education, as presented here, must become a valued subject at every level.

People make decisions about technological activities every day. However, the growing complexity of technological systems means that all technological decision-making should include an assessment of the impacts and consequences of an implemented or proposed technological system.

All technological activity impacts humans, society, and the environment. Moreover, technological activity involves tradeoffs and risks. Decision makers should understand real vs. implied risks associated with technological developments.

Erich Bloch, past Director of the National Science Foundation, said that, "Technologically literate people should be able to read a newspaper or magazine article and react to those articles related to technology on a basis of some understanding, not on a basis of emotion." [16]
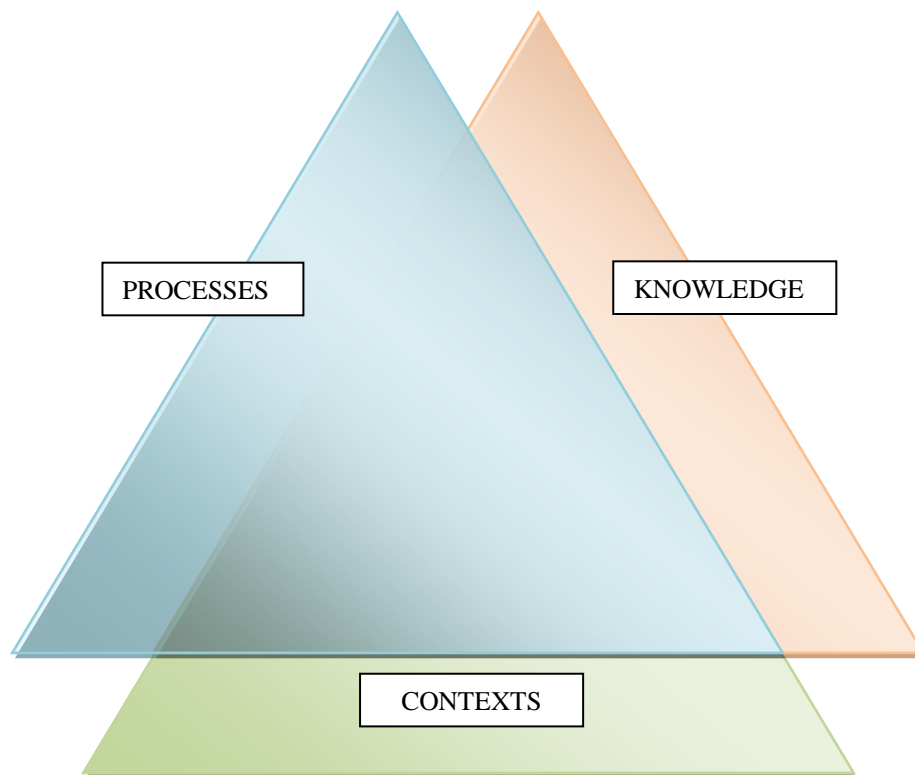

Fig. 1 Technology Universal Model, editing from ITEA[1].

B. Formative Evaluation

Dick et al. [2] distinguish between formatively evaluating one's own instructional materials and formatively evaluating externally selected materials. Many evaluation articles,

strategies, and tools are designed towards the end-user (instructor, teacher, etc.) to help to determine the effectiveness or appropriateness of a piece of instruction or instructional material once selected. "Although most evaluation theorists have said that their models are intended to influence and assist

audiences, for the most part the nature and the role of these audiences has been given little or no special emphasis"[3] The author's interest focused on the formative evaluation of instruction by the designer or developer within the context of the instructional design process. This study was helping designers and developers incorporate the step of formative evaluation of integrating immerging technology into formal into their design process for the purpose of improvement, not leaving it to the end-user to determine appropriate fit.

TenBrink [4] identifies three things that a model of the process of evaluation should do:
1. Clearly specify each step in the process of evaluation
2. Be applicable to all types of evaluation problems
3. Be easy to understand and easy to use

Tessmer [5] notes that all formative evaluations will follow these general steps:
  1. Plan the evaluation
  2. Introduce the evaluation to participants
  3. Conduct the evaluation
  4. Gather and organize data
  5. Make data-based revisions
  6. Evaluate revised version (if possible)

Most formative evaluations follow the same procedures. However, what was found when reviewing the literature to find the most comprehensive formative evaluation on which to base a tool was that no one model contained all steps that the author felt was necessary. Some steps might be considered optionally.

C. Evaluation

In this session, evaluation types, models, approaches are reviewed. Although the words "type", "model", and "approach" are quite of often used interchangeably, they are distinctly different aspects of evaluation.

D. Evaluation Types

There are several basic types of evaluation: planning evaluation (discrepancy analysis), formative evaluation, summative evaluation, predictive evaluation, informal evaluation and formal evaluation.

A Planning Evaluation helps in determining a project's goals, objectives, strategies, and timelines.

Formative evaluation is a systematic and empirical process. Formative evaluation is part of the instructional design process, and can be a "cost-saving measure to economically 'debug' instruction and increase client satisfaction. The formative evaluation process also gives the evaluator the opportunity to evaluate the evaluation instruments, as well as the instruction. Learners can pinpoint confusing questions and tasks, as well as point out problems on an attitude survey. The expert review is a phase conducted very early in the formative evaluation process, while the materials are in their roughest stages. There are several types of expert reviewers: subject-matter (content)

expert reviewers; teacher, parent, or instructor expert reviewers; technical (production) expert reviewers; instructional design or learning specialist expert reviewers, and subject sophisticates. The purpose of the one-to-one evaluations is "to identify and remove the most obvious errors in the instruction, and to obtain initial performance indications and reactions to the content by learners" [2]. Small group evaluations answer use and implementation questions as well as effectiveness questions [5].

Field trials answer use and implementation questions as well as effectiveness questions [5]. The field trial (also called 'beta test' or 'field test') serves to see if changes made after the small group evaluation were effective and whether or not the instruction can be used effectively in its intended context (a situated evaluation).

Summative evaluations are usually conducted by outside evaluators, after a project or program's completion, for purposes of accountability.

Predictive evaluation is used to improve ones chances of being correct when making such guesses.

E. Evaluation Models

Evaluation models either describe what evaluators do or prescribe what they should do. Generally, evaluators are concerned with determining the value or current status of objects or states of affairs.

The term 'model' is used in two general ways.
  (a) A prescriptive model, the most common type, is a set of rules, prescriptions, prohibitions, and guiding frameworks which specify what a good or proper evaluation is and how evaluation should be carried out. Such models serve as samples.
  (b) A descriptive model is a set of statements and generalizations which describes, predicts, or explains evaluation activities. Such models are designed to offer a practical theory.

The importance of studying evaluation models is shown in a number of ways.

1) Tyler's Model outline the seven steps:
  1. Establish broad goals or objectives
  2. Classify the goals or objectives
  3. Define objectives in behavioral terms
  4. Find situations in which achievement of objectives could be shown
  5. Develop or select measurement techniques
  6. Collect performance data
  7. Compare performance data with behaviorally stated objectives

"Evaluation was viewed as a cycle that involved not only clarifying and measuring objectives but adapting teaching

methods and materials to make success more likely"[6]

The Metfessel and Michael Model identify the eight steps:
1. Involve the total school community as facilitators of program evaluation.
2. Formulate cohesive model of goals and specific objectives.
3. Translate specific objectives into a communicable form applicable to facilitating learning in the school environment.
4. Select or construct instruments to furnish measures allowing inferences about program effectiveness.
5. Carry out periodic observations using content-valid tests, scales, and other behavioral measures.
6. Analyze data using appropriate statistical methods.
7. Interpret the data using standards of desired levels of performance over all measures.
8. Develop recommendations for the further implementation, modification, and revision of broad goals and specific objectives

This model was heavily influenced by the work of Tyler. Its major contribution was in expanding the possibilities regarding alternative instruments.

2) Hammond's Model

Hammond [7] developed a three-dimensional cube (see Figure) that he called a "structure for evaluation". The cube was designed to help the evaluator search for factors contributing to the success and failure of educational activities [8].
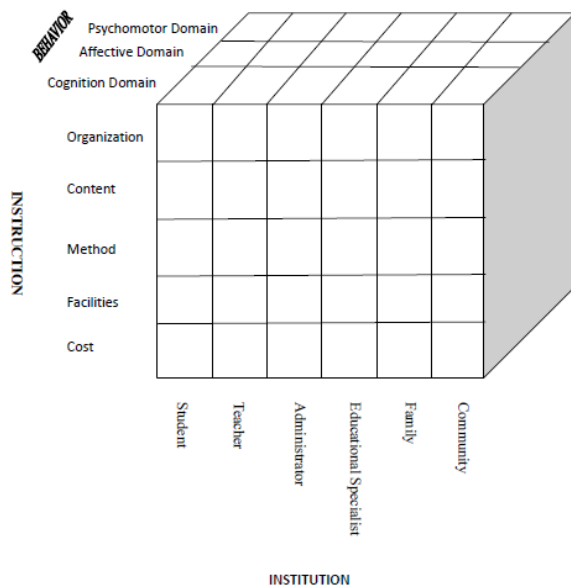

Fig. 2The Hammond Model: A Structure for Evaluation

Alkin [3] identifies five areas of evaluation that attempt to provide information to satisfy unique decision categories:
1. Systems assessment (Similar to context evaluation in the CIPP Model).
2. Program planning
3. Program implementation
4. Program improvement (Similar to process evaluation in the CIPP Model).
5. Program certification (Similar to product evaluation in the CIPP Model).

Pace and Friedlander (1978, p. 7) organize Alkin's Model this way:

Table 1Alkin's Evaluation Model presented by Pace & Friedlander

Decision Area	Type of Evaluation
Problem selection	Needs assessment
Program selection	Program planning
Program operationalization	Implementation evaluation
Program improvement	Progress evaluation
Program certification	Outcome evaluation

3) Stufflebeam's CIPP Model

The CIPP Model (Context, Input, Process, and Product) can be used for both formative and summative evaluation[8]. Perhaps the most significant characteristic of CIPP is that it makes provision for holistic evaluation. Its elements are systems oriented, structured to accommodate universal evaluation needs. They also notes the rarity of an evaluation model that offers process evaluation, as this one does.
- Context evaluation, to serve planning decisions [8] –"is intended to describe the status or context or setting so as to identify theunmet needs, potential opportunities, problems, or program objectives that will be evaluated" [6].
- Input evaluation, to serve structuring decisions [8] –"the evaluator provides information to help the decision maker select procedures and resources for designing or choosing appropriate methods and materials" [6].
- Process evaluation, to serve implementing decisions [8] – "making sure that the program is going as intended, identifying defects or strengths in the procedures" [6].
- Product evaluation, to serve recycling decisions [8] – "a

combination of Alkin's progress and outcome evaluation stages" [6]that serves to judge program attainments.

The CIPP model deals with products or outcomes not only at the conclusion of the program but also at various points during the program. Outcomes are then related to objectives; differences are noted between expected and actual results; and the decision maker decides to continue, terminate, or modify the program

4) Management Model of Evaluation

The Management Model of Evaluation [9] is cyclical in nature. One can enter the process at any point, although each stage builds on another. Harpel notes that the "iterative nature of the model is self-correcting"[9], because eventually all steps will be addressed.

Managers must take into account the resources available and whether or not those resources were used to their best advantage while also keeping in mind the goals of the parent institution or organization. Results of a management evaluation are primarily reviewed by external decision-makers rather than internal program staff.
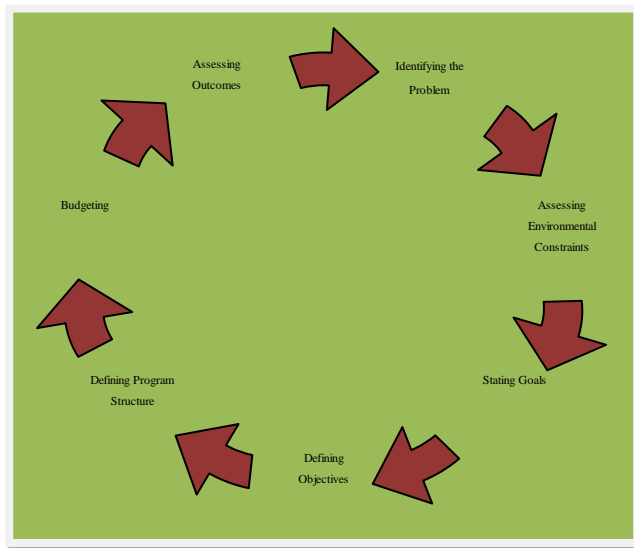

Fig. 3 Management Model of Evaluation

5) Tessmer's Formative Evaluation Planning Process

Tessmer [5] outlines 11 steps that are necessary when planning an evaluation. Although not graphical, the steps are prescriptive in nature and this model constitutes one of only a few formative evaluation models.

1. Determine the goals of the instruction
2. Determine the resources for and constraints upon the evaluation
3. Obtain a complete task analysis of the instruction
4. Describe the learning environment
5. Determine the media characteristics of the instruction
6. Outline the information sought from the evaluation
7. Choose parts of the instruction for evaluation
8. Select the stages and subjects for the evaluation
9. Select the data gathering methods and tools for each stage
10. Plan the report(s) of the evaluation
11. Implement the evaluation

F. Approaches

One of the few things these diverse approaches have in common is the idea that evaluation should determine the worth of the educational program.

In the system evaluation approach, the program is compared with another. Three components are studied by the evaluator to find this information:

- Inputs (the incoming qualities of the students)
- Operations (the characteristics of the program or set of experiences that are intended to promote the students' progress toward the desired aims)
- Outputs (the impact of the program on the participants' attainments of its objectives)

Determining the connections among these three components is the purpose of the Systems Analysis Approach.

The behavioral objectives approach has also been called the Goal-Oriented Approach, the Goal-Based Approach, the Objectives-Oriented Approach[8], the Tyler approach [10], and the Educational Psychology Model [6].

The decision-making approach has also been called the Decision-Oriented Approach, the Management-Oriented Approach[8], and the Educational Decision Model[6].

Goal-free evaluation is the evaluation of actual effects against a profile of demonstrated needs[11]. The value of Goal-free evaluation is not noticing what is expected, but noticing the unexpected.

Art criticism approach has also been called the Expert Approach or the Expertise-Oriented Approach [12]. Worthen and Sanders[12] identify theater critics, art critics, and literary critics as educational connoisseurs and critics. These experts offer direct and efficient application of expertise to that which is being evaluated.

This approach has also been called the Accreditation Approach, the Expertise-Oriented Approach [12], and the Professional Judgment Approach. As mentioned above, Worthen and Sanders combine the Art Criticism Approach and the Professional Review Approach into one approach called the Expertise-Oriented Approach. Worthen and Sanders identify formal and informal review systems, as well as ad hoc panel and ad hoc individual reviews. This approach focuses on the subjective professional expertise of experts for the purpose of

passing judgment.

Quasi-Legal approach has also been called the Adversary Approach, the Judicial Approach, or the Adversary-Oriented Approach [12]. Several names associated with this approach are Rice, Wolf, Owens, Levine, and Kourilsky. The basis of this approach is to balance bias, rather than reduce it, by presenting both the positive and negative views in the evaluation [12].

Case study approach has also been called the Transaction Approach, the Naturalistic and Participant-Oriented Approach [12]. By "case study", they mean "an individual self-evaluation in which the student is both the recorder and reflector of his or her experience. The evaluator is an internal, not an external, evaluator. In this approach, evaluation has a strong possibility of being a learning activity.

III. PROBLEM SOLUTION

Based upon the evaluation characteristics of integrating emerging technology into formal curriculum, related literature were reviewed according to type, model and approach and organized as the proposed model.

A. Proposed evaluation model

The following is the proposed prescriptive formative evaluation model, using the systems approach. The model incorporates the steps identified by Tessmer as being general to all formative evaluations, and honors the three guidelines proposed by TenBrink for a good evaluation model. Many of these steps can also be found in other models. (The referenced models with similar steps have been listed below each step.) These 14 steps condense the formative evaluation process into one that is comprehensive and manageable.

1) *Clarify product/program goals and objectives*

Based upon reviewed literature: [Tyler Model (steps 1 and 2), Metfessel and Michael Model (step 2), Provus' iscrepancy Model (termed "standards"), Stake's Countenance Model (Step 1 – termed "program rationale"), Stufflebeam's CIPP Model, Walker's Evaluation Design Model (step 2), Tessmer's Formative Evaluation Planning Process (step 1), Evaluation Overview (step 1)]

2) *Define purpose of evaluation*

   a) *Clarify evaluation type*

   b) *Clarify evaluation goals and objectives*

Based upon reviewed literature: [Walker's Evaluation Design Model (step 1), Tips for Conducting an Evaluation (step

1), Evaluation Overview (step 2), The Evaluation Process (step 1)]

3) *Determine evaluation questions*

Based upon reviewed literature: [Walker's Evaluation Design Model (under step 1), Tips for Conducting an Evaluation (step 1), Tessmer's Formative Evaluation Planning Process (step 6), Evaluation Overview (step 3), The Evaluation Process (step 2)]

4) *Plan the evaluation*

   a) *Determine evaluator's role(s)*

   b) b. *Identify evaluation design*

Based upon reviewed literature: [Walker's Evaluation Design Model (step 6), Tips for Conducting an Evaluation (under step 2), Tessmer's Formative Evaluation Planning Process (step 8), Evaluation Overview (step 5)]

Select criteria, indicators, and data sources

Based upon reviewed literature: [Tyler Model (steps 4 and 5), Stake's Countenance Model (step 4), Walker's Evaluation Design Model (steps 4 and 5), Tips for Conducting an Evaluation (under step 2), Tessmer's Formative Evaluation Planning Process (step 9), Evaluation Overview (step 4), The Evaluation Process (steps 3 and 4)]

5) *Develop instruments*

Based upon reviewed literature: [Tyler Model (step 5), Metfessel and Michael Model (step 4), Tessmer's Formative Evaluation Planning Process (step 9), The Evaluation Process (step 5)]

6) *Submit evaluation proposal*

   a) *Determine time schedule*

   b) *Determine budget*

   c) *Submit evaluation plan, time schedule, budget, and instruments for feedback*

7) Make revisions to the evaluation proposal **(optionally)**
8) *Schedule appointments for evaluation*
9) *Conduct evaluation*

   a) *Revise evaluation instruments (optionally)*

   Based upon reviewed literature: [Tyler Model (step 6), Metfessel and Michael Model (step 5), Stake's Countenance Model (step 3), Walker's Evaluation Design Model (step 7), Tips for Conducting an Evaluation (step 3), Tessmer's Formative Evaluation Planning Process (step 11), Evaluation Overview (step 6), The Evaluation Process (step 6)]

10) *Organize and analyze results*

Based upon reviewed literature: [Tyler Model (step 7), Metfessel and Michael Model (steps 6 and 7), Walker's Evaluation Design Model (step 8), Tips for Conducting an Evaluation (step 4), Evaluation Overview (steps 7 and 8), The Evaluation Process (steps 7 and 8)]

11) Report results

Based upon reviewed literature: [Metfessel and Michael Model (step 8), Stake's Countenance Model (step 5), Walker's Evaluation Design Model (step 8), Tips for Conducting an Evaluation (step 5), Evaluation Overview (step 9), The Evaluation Process (step 10)]

12) Revise instruction accordingly

Based upon reviewed literature: [Evaluation Overview (step 10)]

13) Publish results

Based upon reviewed literature: [Walker's Evaluation Design Model (under step 8), Tips for Conducting an Evaluation (step 5), Evaluation Overview (step 9), The Evaluation Process (step 10)]

B. Description of each proposed steps

1) Clarify product/program goals and objectives

A prerequisite for evaluation is the development of a project plan with measurable objectives that are logically related to one another and to the goals and interventions defined in the project proposal. Stating goals can be done deductively or inductively. Deductively, stating goals results from translating the needs assessment into the mission of the institutional or organizational programs and activities. Inductively, stating goals results from assessing the institutional or organizational current programs and activities and determining the goals from those activities [9]. Harpel [9] writes, "Whereas the focus of the deductive approach is on the relationship between goal statements and students' needs, the inductive mode stresses the relation between goals and activities" (p. 26). Mager [13] also warns against confusing objectives with goals. Whereas goals are broad, objectives should be more specific and measurable.

Due to the importance of goal statements, everyone involved should be included in the formation and review of goals statements. An evaluation will best serve its clients when the goals and objectives have been negotiated with input from all relevant stakeholders. Unless using a goal-free approach, an evaluator should learn as much as he or she can about the background, goals, and objectives of the program being evaluated [14].

Harpel [9] identifies questions that test for the adequacy of goals:

- Does the goal address the needs of those who are served by the program?
- Does it relate to the activities of the program?
- Does it clearly identify the ideal result of the activities?
- Does the goal recognize the constraints of the environment (for instance, is it consistent with the purposes of the institution)?

C. Define purpose of evaluation

1) Clarify evaluation type

Work closely with all relevant stakeholders to determine what they hope to get out of the evaluation. Determining whether your evaluation is a formative or summative evaluation, or a process or outcome evaluation will help you determine the purpose(s) of your evaluation.

2) Clarify evaluation goals and objectives

Worthen and Sanders [12] distinguish between what evaluation is, "the act of rendering judgments to determine value", and what goals evaluation has (i.e. decision-making). The goals and objectives are the stated purposes of the evaluation, and include decision-making, problem identification, impact determination, and continued program improvement [14].

D. Determine evaluation questions

The evaluation questions determine what data needs to be gathered, when, and from whom. Having stakeholders give input into the process of determining evaluation questions helps to minimize the possibility of a fruitless or disappointing evaluation.

E. Plan the evaluation

Several authors have stressed the importance of evaluation planning [2, 5, 14]. A good evaluation plan should be developed before a project is implemented, should be designed in conjunction with the project investigators, and should ensure that the evaluation serves two broad purposes.

First, evaluation activities should provide information to guide the redesign and improvement of the intervention. Second, evaluation activities should provide information that can be used by both the project investigators and other interested parties to decide whether or not they should implement the intervention on a wider scale.

1) Determine evaluator's role(s)

A formative evaluator should be recognized as part of the program design team whose job is to acquire information that will help the design team improve the program. A clear distinction should be made between the role of the evaluator during the formative stage of the program and during the summative stage.

A formative evaluator should be knowledgeable in the areas of measurement and data analysis, but should also have a background in learning theory and experience in the construction of learning materials. The evaluator's role

should be as more than just the acquirer of useful information. The evaluator should explain to the design team the procedures involved in the evaluation, including data analysis, and should also help interpret the data from the evaluation. The evaluator's role could be as an asset not only in evaluation planning and data collection, but also in program revision.

2) Identify evaluation design

In this step, it is need to determine what data acquisition strategies will be used. Many evaluations fail due to inadequate research designs and poorly selected or constructed outcome measures.

The evaluation question(s) will help determine the most appropriate design. Understanding the strengths and weaknesses of various research designs will help evaluators match the research question with the best possible approach. The purpose of the evaluation should influence the design of the evaluation.

F. Select criteria, indicators, and data sources

Before obtaining information, one must first know what judgments and/or decisions are to be made. Knowing what judgments and decisions are to be made not only aids in obtaining the right information, but also how and when to obtain the information [4]. Determine what data will be necessary to obtain in order to make informed decisions.

Dick [2] noted in his study of programmed instruction that the ability of the student mattered to the designer when considering the comments that student made. Determine if this might be a factor to you or the designers and administrators making decisions, and determine indicators and create instruments accordingly.

Determine what data is useful for the evaluation that already exists, and determine what new data will need to be collected. Failures in evaluative research are frequently due to a poor link between whatever was assessed and the goals of the program.

Thus, the first step in deciding on outcome measures must be to determine carefully what the program is meant to accomplish and exactly what changes would finally occur if it met its goals.

G. Develop instruments

It is extremely important when developing instruments to get input from all relevant parties. The instruments need to gather data that is relevant and productive for those who designed and developed the product, and for those who will make decisions regarding the product. Dick et al. [2] speak to the design of formative evaluation instruments from an instructional design perspective, "Using the instructional strategy as the frame of reference for developing evaluation instruments and procedures should help you avoid designing a formative evaluation that is either too narrowly focused or too broad". Good formative evaluation includes assessing both achievement and attitudes.

When measuring proficiency, standardized tests are useful. Outcome measures fall into one of three groups: direct measures of exactly what are trying to be changed, "off-the-shelf" measures that have been pretested in other settings, and "build-your-own" measures designed along with the study. The first two are obviously preferable, since negative results can then be attributed to the program" The key is to determine whether the instrument is valid for your purposes.

H. Submit evaluation proposal

1) Determine time schedule

The time needed for an evaluation depends on many factors, including (but not limited to): the number of steps to be incorporated, the type of steps to be incorporated, the number of participants selected, the participants' schedules, the evaluation budget, the time required to incorporate changes, and the overall product or project timeframe.

2) Determine budget

At a lesser cost? Can greater benefits be reaped at the same cost?

This is an area of cost analysis not currently incorporated in Determining the budget of an evaluation is a difficult task. A rough estimate could vary greatly depending on the type of project, the purpose of the evaluation and the depth of the evaluation. More specifically, determining the exact costs associated with an evaluation is an elusive task. There are the costs of adoption of a product/program, costs for human resources, and costs for material resources. There are differences between projected costs and actual costs, initial costs and ongoing costs.

Determining budgetary considerations (possible human and material resources) may be the first step in budgetary planning for an evaluation. Having a tool that could help to simplify the process of determining resources and costs might prove very useful. Exact cost estimates may never be able to be achieved, but is worthy of further research.

Another area of budgetary concern is cost efficiency/effectiveness (also known as cost-benefit analysis or systems analysis). Specifically, is what is gained worth the costs involved? Can the same rewards be reaped to the tool in its current design, although it is certainly a worthy undertaking. The tool's current goal of budget determination centers on the determination of factors directly related to implementing a formative evaluation of the program/product being developed: the time involved (human resources), the materials required (materials resources), and other miscellaneous or overhead expenses.

3) Submit evaluation plan, time schedule, budget, and instruments for feedback.

Feedback from stakeholders (whether management, the funding agency, or others involved less directly) as to the thoroughness, timeliness, and fiscal responsibility of the planned evaluation is much more acceptable at this stage than at a later stage. At this stage, comments or changes can be incorporated relatively easily. What one wants to avoid is conducting an evaluation that doesn't meet the purpose outlined due to the gathering of the wrong information, or the information was gathered at the wrong time, or a plan was accepted that could not be implemented due to financial restrictions.

I. Make revisions to the evaluation proposal

Feedback from all stakeholders (and especially those directly involved in the evaluation) may prompt a revision of the evaluation plan, time schedule, budget, instruments, or all of these. This step provides for revisions now, when such changes can be made relatively easily.

J. Schedule appointments for evaluation

Identifying who will be involved, how, and when is an integral step in the process of the evaluation.

K. Conduct evaluation

After conducting a portion of the evaluation, problems in question wording or instrument presentation may be realized. Identifying such problems and addressing them can make the information gathered during subsequent stages much more useful.

L. Organize and analyze results

Organizing and analyzing the data can be done using several possible strategies. These may include describing, counting, coding, clustering, comparing, finding co-variation, and telling a story.

M. Report results

Reporting evaluation results to relevant parties is a crucial step in the evaluation process. Designers, developers, and decision-makers will use the report to make improvements, revisions, and modifications to the instruction or materials. Administration, management, and funding agencies will use the report as documentation of the evaluation efforts and for funding considerations. Evaluation participants will view the report to see how their input affected the results. The importance in recognizing the report audience and their informational needs are serious. The best evaluation is totally useless if the reports are not read or are not understood by those responsible for making decisions or expected to make the changes. Very often reliance on a single report will prove inadequate because different populations have different needs for the degree of technical sophistication, comprehensiveness, and detail of information.

One should consider when developing appropriate reports for targeted audiences identifying the audience's special information needs. The most appropriate communication strategies for each audience should be identified as soon as possible. A timeline needs to be developed that will guide when specific information will be shared with targeted audiences especially as the reports relate to formative evaluation.

N. Revise instruction accordingly

Determine if problems were due to a faulty program, to a faulty instrument, or both. Develop revision strategies and priorities.

O. Publish results

Publishing or publicizing your results is an important step in the evaluation process. These results may be made available to outside, interested parties via journals, newsletters, web sites or other electronic venues, or other publications.

In addition to the steps outlined above, the following suggestions regarding formative evaluation are valuable to keep in mind. Four strategies are listed to ensure that evaluation activities are an integral part of any project.

- Establish a routine information system for the project, including inputs (time, resources), outputs (activities completed, student contact hours), and outcomes (student course grades, interim results of evaluation activities). Once established, a member of the project staff should be held responsible for keeping the information system up to date.
- Include evaluation activities in the project budget.
- Hold regularly scheduled monitoring and evaluation meetings for project staff.
- All those who work on a project should be familiar with the project objectives and how they will be evaluated.
- Encourage review and revision of the evaluation plan… Do not hesitate to revise aspects of the evaluation plan – to strengthen the research designs, select alternative indicators if the original ones are not sufficiently sensitive to project achievements, or incorporate the results of formative research.

IV. CONCLUSION

This study proposed an evaluation model of integrating emerging technology into formal curriculum. An evaluation with determining information could be used for designing a well organized and effectively curriculum of emerging technology. The model includes total possible fourteen stages. Those are listed as followings.

1. Clarify product/program goals and objectives
2. Define purpose of evaluation
    a. Clarify evaluation type
    b. Clarify evaluation goals and objectives
3. Determine evaluation questions
4. Plan the evaluation
    a. Determine evaluator's role(s)
    b. **Identify evaluation design**
5. Select criteria, indicators, and data sources
6. Develop instruments
7. Submit evaluation proposal
    a. Determine time schedule
    b. Determine budget
    c. Submit evaluation plan, time schedule, budget, and instruments for feedback
8. Make revisions to the evaluation proposal (optionally)
9. Schedule appointments for evaluation
10. Conduct evaluation
    a. Revise evaluation instruments (optionally)
11. Organize and analyze results
12. Report results
13. Revise instruction accordingly
14. Publish results

This formative evaluation model is a mean for understanding how integrating emerging technology content into formal curriculum is going. Based on the evaluation goal, criteria should be identified before evaluation could be conducted. The model is fulfill the needs of a system to pin point effects of integrating emerging technology into formal technology education, so can reveal the integral information and characteristics of curriculum innovation.

REFERENCES

[1] ITEA, Standards for technological literacy, Content for the study of technology. Executive Summary. Va: Reston, 2000.
[2] W. Dick, et al., The Systematic Design of Instruction, 5th ed. New York: Longman, 2001.
[3] M. C. Alkin, & Ellett, F. S., Jr., "Evaluation Models: Development," in The International Encyclopedia of Education, T. H. T. N. Postlethwaite, Ed., ed Oxford: Pergamon Press, 1985, pp. pp. 1760-1766.
[4] T. D. TenBrink, The evaluation process: A model for classroom teachers, Evaluation: A practical guide for teachers. New York: McGraw-Hill, 1974.
[5] M. Tessmer, Planning and conducting formative evaluations. London: Kogan Page, 1993.
[6] D. L. Stufflebeam, "The CIPP Model for Evaluation," in Evaluation in Education and Human Services. vol. 49, G. F. Madaus and D. L. Stufflebeam, Eds., ed NEW YORK: KLUWER ACADEMIC PUBLISHERS, 2002, pp. 279-317.
[7] B. R. Worthen and J. R. Sanders, Educational evaluation: Alternative approaches and practical guidelines. New York: Longman, 1987.
[8] M. C. Alkin and F. S. Ellett, Jr. , "Evaluation Models: Development," in The International Encyclopedia of Education. vol. 3, T. H. T. N. Postlethwaite, Ed., ed Oxford, England: Pergamon Press, 1985, pp. pp. 1760-1766.
[9] C. R. Pace and J. Friedlander, "Approaches to evaluation: Models and perspectives," in New Directions for Student Services, G. R. Hanson, Ed., ed San Francisco: Jossey-Bass Inc., 1978, pp. pp. 1-17.
[10] R. L. Harpel, "Evaluating from a management perspective," New Directions for Student Services, pp. 19 - 33, 1978.
[11] R. F. Mager, Preparing instructional objectives, 3rd ed. Atlanta, GA: The Center for Effective Performance, Inc., 1997.
[12] S. Quinones, et al., An educator's guide to evaluating the use of technology in schools and classrooms. Washington D.C.:U.S. Department of Education., 1998.
[13] Kuo, L.H., Yang, H.H., Yu, J.C., Yang, H.J, Lin,L.. (2010). Identifying the Course Role of In-service Learning via the Social, Network Structure. WSEAS Transactions on Communications,9(9),583-594.
[14] Kuo, L.H., Yang, H.H., Yu, J.C., Yang, H.J, Lin,L.. (2010). Identifying the Course Network Structures Based upon Records of In-service Learning Database. WSEAS Transactions on Communications,10(9),1224-1234
[15] Kuo, L.H., Yang, H.H, Yang, H.J., and Chen, C.H., Identifying a General Structure of Teachers' In-service Learning, International Journal of Education and Information Technologies, 6(1), 105-113.

Lung-Hsing Kuo received his Master (M.E.) in Education (1990~1993) and Ph.D. in Education from (1993~1997) National Kaohsiung Normal University. He is the director of the center for teacher career and professional development in National Kaohsiung Normal University. His research interests include social Science Research Methodology, Continuing Education, Human and social, Youth Study, Emotion development and management, Counseling and Education Issues.

Huei-Mei Wei obtained a Master (M.E.) in Education and a Ph.D. in Education from National Kaohsiung Normal University. Ser research interests include curriculum evaluation, gender education, educational theory, and educational psychology. Her research has appeared in a variety of journals including those published by the NAUN and WSEAS.

Li-Min Chen obtained a Master in Photojournalism from department of visual communication, OHIO University. He received Ph.D. in Design from National Yunlin University of Science and Technology. He is the director of center for Instructional & Learning technology in National Kaohsiung Normal University. His research interests include visual communication design and photography.

Ming-Chen Wang received her Master (M.E.) in Adult Education from National Taiwan Normal University and is working as a Ph.D. candidate in Industrial Technology at National Taiwan University. He is the principle of Pingtung County Fang Liao High School and hosts High Scope Project for creating new curriculum of emerging technology. His research is focused on human resource development through technology education.

Miao-Kuei Ho received her Master (M.S.) in Industrial Technology Education from National Taiwan Normal University. She is major in curriculum development and promoting technology education. She had cooperating NSC research projects for nine years and contributes technology education study with fruitful fields experiences.

Hung-Jen Yang obtained a Master (M.S.) in Technology Education from University of North Dakota and a Ph.D. in Industrial Technology Education from Iowa State University. He is currently conducting research on knowledge transfer, and knowledge reuse via information technology. His research has appeared in a variety of journals including those published by the WSEAS.