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The use of Interactive Multimedia (CDROM) in Training Extension Workers on Flip Chart Technology

R.R.A. Wijekoon and S. Newton[1]

Audio-Visual Centre, Department of Agriculture
Peradeniya, Sri Lanka

ABSTRACT. *There is more emphasis on technical training than on broader communication and presentation skills in the existing training programs for extension workers. Well-designed and effectively used communication material has a vital role to play in the process of extension communication. A mail survey conducted for this research, among agricultural extension organisations in developing countries has shown that the media and audio visual production centers focus largely on the production of mass media material rather than training extension workers to produce their own audio visual aids. Furthermore this survey clearly indicated that flip chart is the low-cost audio-visual technology most widely used by extension workers in the training of farmers. Considerable research into flip chart technology was required to develop a suitable curriculum for this technology, as the published information is of little relevance to this 'little media'. In order to address a broad range of design issues pertaining to flip chart technology, an interactive multimedia (CDROM) has been developed. In addition to extensive technical and user testing in Australia, several trials of the CDROM assisted training were undertaken in Sri Lanka. Nine training strategies with different variables (type of trainers, mode of utilisation of CDROM, type of assistance during training) were tested at Audio-Visual Centre and regional training centres of the Department of Agriculture. A key indicator of the success or otherwise of each trial (training program) involved a performance evaluation of each extension worker at the end of the training session. The results indicate that training program utilising multimedia technology alone is not effective at present to develop flip chart skills. A more integrative approach to the use of multimedia technology and traditional training methods is shown to produce remarkable improvements in this context. Extension workers at regional extension system must be able to produce their own low cost audio visual aids by utilising CDROM technology in the future without depending on a central media production system.*

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1 School of Design, University of Western Sydney, Australia.

INTRODUCTION

Agriculture plays a major role in economic development of a developing country. As a principal economic sector, and central to the well being of such a large proportion of the population, agricultural extension is a major consideration for developing countries. Many developing countries have their own extension system to uplift the living condition of farming community through creating awareness for new technology or improved technology.

Extension workers traditionally, first and foremost, were specialists in agriculture (particular aspects of agronomy, livestock health and production, farm commerce, *etc.*). In new extension approaches, however, a greater emphasis is given for local farmers in determining their own development and training activities. From a traditional role as the specialist agricultural change agent, providing technical information to the farmers, the extension worker has now moved to take on wide spectrum of activities at the village level (trainer, facilitator, action researcher, communicator *etc.*). This move similarly has extended, broadened and greatly increased the training components associated with extension workers.

It is no longer sufficient for an extension worker in a developing country to have only technical, specialist knowledge. In order to be effective in a technical sense, the extension worker increasingly must also be able to communicate effectively. Well-designed and effectively used communication material (audio-visual aids) has a vital role to play in this process of communication (Linney, 1995; Boeren, 1994; Adhikarya, 1994). However, agricultural extension organisations in most of the developing countries have no formal training programs or trained professionals to conduct training on design and production of audio-visual material, especially on low cost material (Somasekharappa, 1983; Adhikarya, 1994; Wijekoon and Newton, 1998). On the other hand, requirement of audio-visual material cannot be fulfilled through a central production system, as the requirements are location specific. A better system would be to provide training to individual extension worker to produce his or her own audio-visual material using the locally available material.

The results from a mail survey conducted by the senior author among sixteen developing countries and 12 districts in Sri Lanka revealed that flip chart was the most appropriate audio-visual aid for extension workers and their in-service trainers (Wijekoon and Newton, 1998).

The objectives of the study

1. To develop a proper curriculum for flip chart technology
2. To investigate a proper delivery mechanism to disseminate flip chart technology.

This paper first describes the methodology adopted to develop a proper curriculum (subject matter) and a suitable delivery mechanism (interactive multimedia) for flip chart technology. Then it discusses the strengths and weaknesses of this delivery mechanism to train extension workers on production and use of flip chart.

MATERIALS AND METHODS

An overview of flip chart technology

Low cost audio-visual aids refer specifically to those media which are designed and produced by the users themselves, using content and/or materials which can be found locally. They are, what Linney (1995) refers to as, "People Centred" audio-visual aids. Among broad range of media and technologies which fit the criteria for low cost audio-visual aids, the locally produced flip charts have a number of positive attributes:

- having the content designed and produced locally makes it directly relevant to the specific needs of that community
- locally designed and produced material can also be made more sympathetic to the local community in terms of the graphic styles of images (targeting particular levels of visual literacy), the use of appropriate terminology (local dialects), and language (levels of literacy)
- the flip chart can also be used in less conventional ways, to replicate many of the features associated with more recent audio-visual technologies.
- it is lightweight and compact in size, making it highly portable. This means it can be readily transported to almost any location and/or extension activity, for field days, demonstrations, field trips, *etc.*

- as the producers of material, the users are better able to make sense, and use, of the media resources in training setting

- gaining appropriate skills and knowledge on the design and production of media can help improve the professional credibility and confidence of extension workers (Adhikarya, 1994).

These features have made the flip chart one of the most popular audio visual aids for training, even to this day (National Audio Visual Supply, 1992; Charles and Clarke-Epstein, 1998). It is perhaps second only to the OHP in terms of popularity for corporate training (Jolles, 1993), and extensively used to support extension training in developing countries.

The major problem with low cost audio-visual aids, is that they are largely ignored, or at least viewed as out-dated, by the broader research community. The lack of published information on low cost audio-visual technology is nonetheless surprising, given their widespread use. The stigma attached to older technologies clearly plays a part.

> "The reason is not that they are not being used. A likely explanation is that these media do not appeal to development thinkers and policy makers... These smaller media can truly be called the stepchildren of development communication. They receive little attention although they are quite appropriate for rural areas in development countries." (Boeren, 1994: pp. 121).

Development of a curriculum for training on flip chart technology

Effective guidelines for the use and general principles for effective design and production of flip charts are difficult to source. What published information is available in this regard, tends to be rather old and becoming irrelevant. For example, a major search of literature databases, library catalogues and Internet resources found almost no current information directly related to the design and production of flip charts. Much of the material for flip chart technology has therefore been developed, using a broad spectrum of secondary source material (from graphic design, education, training, media studies, communication theory, *etc.*) and researchers' own experience in low cost media technology.

The first step in planning a training program is the selection of suitable content to be included in such a training program. This is known as training need identification. A range of four (4) tasks related to the flip chart technology was identified. Each of these tasks in turn was further analysed to determine the particular actions/activities required to complete each of them most effectively. Each activity was then considered in terms of the perceived problem (any shortfall identified between the desired performance of that activity and actual performance by extension personnel), its significance (whether the problem is common and impactful, warranting a specific training response), and its treatment (what specific skills are required to be taught as part of that specific training module).

The full list of activity (16) to be included in the overall training program is as follows:

Task 1 : Adopt appropriate design principles for page design
- Activity 1 : Applying appropriate design elements
- Activity 2 : Applying the principle of 'simplicity' for page design
- Activity 3 : Applying key layout principles for a page design
- Activity 4 : Applying appropriate graphic design devices for a page design

Task 2 : Adopt appropriate graphic techniques for production
- Activity 1 : Applying appropriate lettering principles for page construction
- Activity 2 : Following the correct free hand lettering technique for *Sinhala* lettering
- Activity 3 : Following correct freehand drawing techniques
- Activity 4 : Following appropriate freehand drawing techniques for animals
- Activity 5 : Using alternative drawing techniques
- Activity 6 : Following appropriate colouring techniques

Task 3 : Employ effective visualisation techniques
- Activity 1 : Deciding when to use visuals
- Activity 2 : Applying design principles for people-centred visuals
- Activity 3 : Pre-testing audio-visual aids
- Activity 4 : Applying basic principles for drawing graphs and/or charts

Task 4 : Employ effective presentation techniques
- Activity 1 : Using the flip chart in a classroom training situation
- Activity 2 : Applying various special techniques

Interactive multimedia technology was selected as suitable delivery mechanism to train on above range of activities.

A delivery mechanism-interactive multimedia (IMM) technology

IMM is one of commonly used computer assisted instructional technologies that allows user to access information stored in multiple forms including text, graphics, video and audio. This technology allows the learner to interact with the computer program to select, control and pace the learning experience. Since the media is in a digital format, an IMM product can be ported from one computer to the next. Traditionally, porting digital media from one computer to another was achieved using magnetic disks. The magnetic disks stored the digital information in a standard format, which other computers could later decode back into the original digital media. Common magnetic disk might only store slightly over 1MB (megabyte) of information. This level of storage capacity was adequate where the media was limited to text, but with the advent of multimedia 1MB became highly restrictive.

The computer conversion of the CD is called CDROM, a compact disc with read only memory (Apple Computer, 1994). The CDROM is preferred to a magnetic disk because the laser CD technology is able to encode significantly more information than a magnetic medium. The typical CD, for example, can store up to 650 MB of information. With the growth in IMM, the CD technology was soon converted to run on computers, and accommodate any form of digital media (Barron and Orwig, 1995). The development of a mass market for CDROM technology, in which the CDROM drive is now a standard component of new personal computers, has resulted in the CDROM becoming far and away from the most economic form of digital media mass storage and transport (Feldman, 1997).

The IMM design and production process

A detailed description of content outline was developed for sixteen activities identified against each of the tasks identified in the training need analysis process. A diagrammatic representation of the nodes and links structure was designed in a flow chart to visualize the sequence, options and interactive structure of two IMM programs.

Having determined the content outline and the information structure, a template structure for each and every screen (page) for two IMM programs

was designed. Consistency in regards of screen layout (title and sub headings of the page, placement of texts, graphics, icons and navigational devices *etc.*) was maintained throughout the program.

After determining the interactive and visual structure of a screen template, specific content of each page was determined through story boarding. A designing an appropriate user interface design was the next step involved in the process of producing IMM programs. The important factors considered in designing user interface can be summarised as follows.

- Familiar metaphor - Since a book is a familiar item for the target audience various functions that can be found in a book (a cover page, contents page, chapters, index, navigation buttons to flip forward, and backward *etc.*) were incorporated within the IMM program (Figure 1).

- Navigational scheme - A proper navigational scheme was designed to ensure the user is oriented at all times. This was achieved through providing clues (chapter and section heading on every page, colour-coded backgrounds *etc.*) (Figure 1) and other facilities (readily access to map and index pages) about the location of the user relative to the IMM program.

- Extent of user control - All the necessary instructions (prompt for clicking the mouse, closing windows *etc.*) were given to facilitate non-threatening learning environment.

- Media integration - The notion of a primary book metaphor has been expanded considerably by the inclusion of multimedia elements (video, narration, animation, illustrations *etc.*)

- Graphic design - Some of the effective graphic design concepts (such as simplicity, consistency, clarity, balance, harmony *etc.*) were implemented when designing pages of the IMM program.

- Pedagogical dimension - The main concept used to enhance effective learning was the knowledge construction mode (known to unknown, incorrect design to correct *etc.*) rather than knowledge absorption (Figure 2).

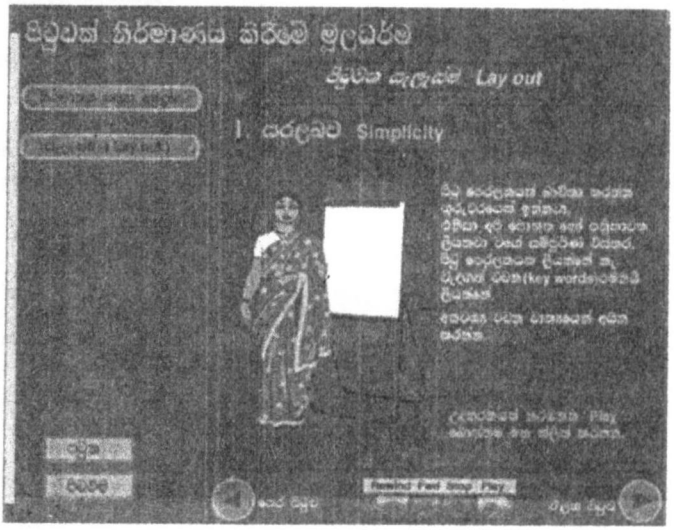

Figure 1. **An example page from the flip chart IMM program, showing the book metaphor.**

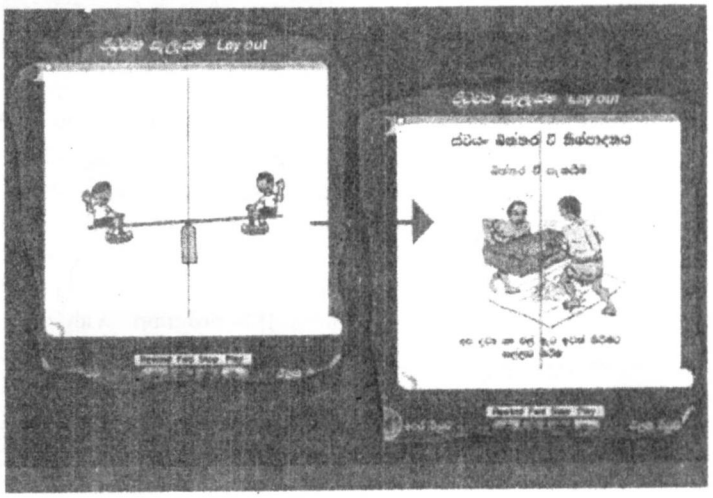

Figure 2. **Knowledge construction, building complex new concepts from simple familiar ones.**

- Graphic library - A collection of 1200 agricultural related graphics were incorporated for users to copy and paste in their flip chart productions

After determining all the above considerations the actual production of two IMM programs was begun with the use of Power Macintosh 7200 and software. Some of the important production procedures adopted to develop different media elements are given below:

- Text - Text was created through Adobe Photoshop. 'Anuradha' (a Sinhala font) font was used for the program.

- Images and graphic elements - Images and graphics were produced in Adobe Photoshop and saved in 8 bit colour depth and PICT format for easy manipulation of small files.

- Audio - The narrated voice-over was used to supplement on-screen text illustrations, video and animations. Sound Edit 16 program was the main program used for audio manipulation.

- Animation - Most of the complex concepts (Sinhala lettering, human figure drawing, theory of balance *etc.*) were demonstrated through animation by using Macromedia director.

- Video clips - Actual demonstrations (such as flip chart and OHP presentation) were presented through video rather than text, photographs, animations *etc.* due to effective comprehension and retention capability. Video manipulation was done in Adobe Premiere.

- Multimedia authoring - All the above media elements were finally incorporated in an IMM program with all the interactivity by using the Macro media director program.

- Prototype testing - Prototype testing was conducted for the entire duration of an IMM program development, starting from the planning stage and continuing throughout the final production.

Trials of the training system

Above CDROM was incorporated to nine training strategies by considering different variables. These training strategies were tested at the Audio-Visual Centre and regional training centres of the Department of Agriculture in Sri Lanka. 153 participants participated for nine training programs. The variables cover key aspects of the training system as follows. Details of variables will be given under the section; 'Results and Discussion'.

- Type of instructor for teaching (media designer, artists, regional agricultural trainers)
- How the IMM program is used in teaching (whole CDROM, selected parts of the CDROM)
- How the IMM program is used by participants (before teaching, after teaching, without any teaching)
- Type of instructor for practical sessions (media designer, artists, no assistance)
- Type of participants (extension workers, in-service trainers)

After formulating 9 (nine) training strategies, two assessment instruments were selected to assess these training strategies. To identify views of the sample on instructor(s), training methodology, delivery mechanism, content, utilisation of the CDROM *etc.* of the training strategies, assessment instrument one; structured questionnaire was developed. To measure behavioral change due to training, assessment instrument two; performance evaluation procedure was developed. In addition to above two evaluation instruments, interviews, observations and discussions were carried out with groups and individuals in informal manner.

Case studies were undertaken in the existing facilities of the Audio Visual Centre (AVC) of the Department of Agriculture (DOA) and regional agricultural training centres in Sri Lanka.

RESULTS AND DISCUSSION

Results of the evaluation instrument one - structured questionnaire

The instrument used in the level one evaluation was the questionnaire and participants were asked to complete this at the conclusion of the training program. Key findings of the questionnaire are given below.

The first section of the questionnaire was devoted to gather information related to demographic data and background information about the audience. The sample comprises of 38% extension workers, 45% trainers and 17% other category officers (doctors, engineers, administrators *etc*). Forty five percent of the respondents have had no previous experience in the use of computer for learning. A similar 43% of the sample indicated that they had basic knowledge in computer technology. There were only 12% of users in the sample with any real experience in the use of computers, and no expert users were indicated. The highest percentage of novices (90%) were found among the extension workers. The results of the study also indicate that a majority of participants (88%) at least have basic knowledge in flip chart technology. Generally staff of the DOA show the highest percentage of working knowledge, most probably due to their previous exposure to training at the Audio-Visual Centre (AVC).

Next section of the questionnaire deals with information regarding different IMM-based training strategies tested for the research work. The main objective of this section is to gather information regarding ways and means of using IMM technology for training, and identifying possible limitations from the perspective of the extension workers and their trainers. A relatively large proportion (41%) have directly stated their uncertainty to replace the current AVC training with IMM assisted training. Since this opportunity was the first exposure to any form of IMM for the majority of participants, most participants would be reluctant to commit one way or the other until having more hands-on experience of the technology. Participants also could be thinking about the facilities required for this new technology, and be unsure whether they are within their reach. The majority of participants agreed (83%) to the use of IMM as a teaching aid to support face to face classroom audio-visual training undertaken in the regions. Most of the respondents (82%) were of the view that IMM programs can be used for self-learning after face to face training with the use of CDROM as a teaching aid in the classroom. On the other hand 75% agreed with the use of IMM programs as a self-learning tool before conventional training in the classroom. Both these results indicate general support for both approaches, with a slight

preference on the part of participants for using the IMM programs after teaching. These results also indicate the value of IMM technology as a self-learning tool and they also expressed strong support for the role played by the teacher for short teaching sessions. The majority of respondents (73%) indicated that IMM programs could be used as resource material (graphic resource, case studies of flip charts *etc.*) for audio-visual production at the regional level (visual aids for training, multimedia campaign and exhibitions *etc.*). There were strong support (88%) for the use of selected agricultural officers as master trainers in IMM based audio-visual training in their regions. However, there was less support (78%) for use of extension workers as master trainers.

The intention of the questions in the next section was to determine the potential barriers, which constrain the implementation of IMM programs to support training. The clear majority (88%) have indicated that lack of suitable computers, especially with CDROM facilities may be the main barrier for implementation of IMM training in Sri Lanka. A significant proportion (50%) indicated that computer anxiety would not be a problem. Many of the participants commented afterwards that their computer anxiety was over having used the IMM program.

The last section of the questionnaire was devoted to gather information regarding utility and performance of the IMM program (its ease of use, navigation, cognitive load, mapping, screen design, knowledge space, information presentation, media integration, aesthetics and overall functionality). Outstanding features of the computer based training package as indicated by participants are given in Table 1. For each criterion, a number of statements were developed. Users were asked to respond to each statement by ranking their response on a five (5) point scale from strongly disagree (equals 1) to strongly agree (equals 5) .

Results of the evaluation instrument two-performance test

As a key component of each training strategy, participants in the training program were each required to produce and present a flip chart at the end of the training program. The production element provide essential practical experience in the design and production process. The presentation element simulates a normal working condition, with other participants taking the role of target audience.

The level of performance demonstrated by individual trainees in various activities/skills for flip chart technology was observed and measured (measurable activities were formulated; *e.g.*, title must be placed top left-hand corner of the flip chart) after each training strategy.

Table 1. Outstanding features of the IMM program.

Item on questionnaire	No.	Strongly disagree	Disagree	Perhaps	Agree	Strongly agree	Score
1. The CDROM was aesthetically pleasing	152	nil	1% (2)	9% (13)	74% (112)	16% (25)	4.1
2. The information was presented in an effective way	153	nil	1% (1)	8% (12)	72% (111)	19% (29)	4.2
3. The CD provides a more interesting learning experience than face to face classroom training	152	nil	3% (5)	9% (13)	70% (107)	18% (27)	4.1
4. Different media elements (a mix of video, animation, text) enhance the learning experience	152	nil	2% (3)	5% (8)	71% (108)	22% (33)	4.2
5. The information presented was easy to comprehend	152	nil	nil	8% (12)	72% (109)	20% (31)	4.1

The range of activities associated with flip chart training are drawn across the three general areas of layout principles, production techniques and visualisation techniques. Across this broad range there is a total of 60 skills, comprising 4 essential, 26 desirable and 30 optional skills.

- essential, where the activities are considered to be absolutely critical to the required competency, 100% achievement is expected
- desirable, where the activities are not critical, but are very important to the required competency, 80% achievement is expected (meaning 80% of the total number of activities listed in this category have to be achieved)

- optional, where the activities may or may not be required in a particular situation, no measurable standards have been established.

The major findings from performance test can be divided between those which relate directly to the 60 skills included in the IMM program, and those which relate to the key features (variables) of different training strategies.

Findings related to variables of training strategies

As the results indicate, a significant difference is apparent between those strategies in which assistance is provided during the practical sessions (Strategies 2, 4, 6, 8, 10 and 11) and those where it is not (Strategies 5, 7 and 9). Strategies in which assistance is provided show a marked improvement in performance over those where no assistance is provided.

As indicated in Figure 3, strategy 6 has achieved very high standards: 86% for essential skills, and 100% for desirable skills.

In this strategy, trainees were allowed to use both CDROMs for self-learning at the beginning of the training program (before a lecture). Important sections of the CDROMs were used as a teaching aid for a one hour lecture (discussion) by a media designer at the end of the self-learning period. A media design assistant of the AVC assisted in practical session. There are many possible reasons for the success of this particular training strategy. These include:

- the participants come to the teaching session having already explored the IMM program. The teacher then has only to present the most important sections of the IMM program, as a form of revision and discussion. Having already studied the IMM program, the participants are better able to engage in meaningful discussion and interaction on the different topics. This means participants have opportunity to clarify any problems and confusions in discussion with the teacher and other members of the training group. This discursive and interactive mode of learning helps participants to comprehend and retain material in an effective manner.

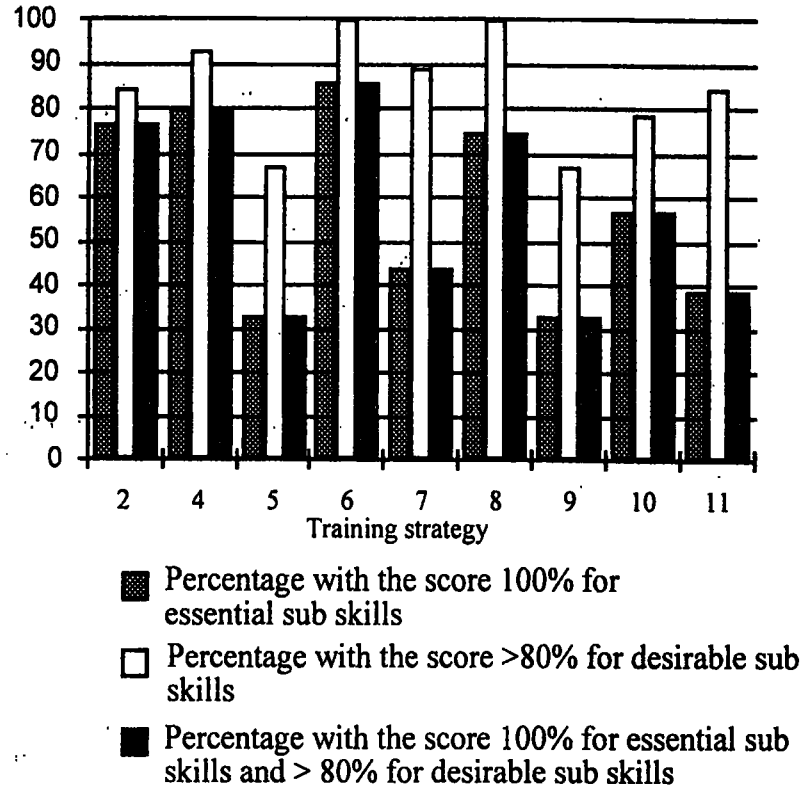

Figure 3. Performance of participants across all training strategies.

- the participants move directly from discussion into the practical sessions, which allows them then to concentrate on the important psychomotor skills. The tendency to make mistakes in the practical sessions is greatly reduced by having a problem - focussed discussion immediately beforehand

- the assistance during the practical sessions was very successful with particular regard to the more creative, visual literacy skills (identified as essential skills to produce a flip chart). There were no problems observed in this group in terms of three essential skills (out of four).

- the assistance during practical sessions was also very successful in reducing the common mistakes made by participants largely out of habit, such as using correct letter thickness, avoiding the use of unnecessary words (repeating words, combining words), use of decorative shaded letters, and ensuring that the dimensions of diagrams are visible.

- the assistance similarly helped significantly with skills dealing with difficult concepts, such as the low of third, alignment problems (left or centre alignment, arrangement under sub-headings, indenting, *etc.*) and proximity.

- having an assistant available provided better opportunity to experiment with novel equipment such as the overhead projector, used for enlarging. In other cases, participants were reluctant to use novel equipment and depended on one member of the group to take the initiative, which often wasted time.

- in addition to highest performance of this strategy, use of selected parts of the IMM programs to support face to face training could reduce involvement of trainer (media designer) for teaching (only an hour of discussion was needed).

The strategy 4 scored a similarly high performance to strategy 6 in terms of the essential and desirable skills, but the performance in optional skills is markedly inferior. The two strategies are actually quite similar, except that teaching in strategy 4 came before the participants were able to explore the IMM programs in self-study. The main factors responsible for the shortfall in performance would therefore include:

- with the teaching session occurring before participants were able to explore the IMM program, the teacher had to spend significantly more time explaining the concepts, using the IMM program as a teaching resource. It took at least 3 hours for teaching, even when only selected areas of the IMM program were presented. The session was also primarily a one-way mode of teaching, as participants were not in a position to enter into a discussion

- as the practical session in strategy 4 was not undertaken until the participants had first completed their period of self study,

there may have been a tendency to forget some of the more difficult new concepts taught by the teacher.

The third most successful of this group of strategies (strategy 2) involved the participants as rather more passive recipients during the training process as the entire content of the IMM program on flip chart technology was used by a media designer as a teaching aid. The participants were less able to enter into meaningful discussion with the teacher, and had no opportunity to construct their knowledge through self-study. The comprehension and retention rates in this group suffered as a consequence.

Interestingly, the performance of strategy 2 is not markedly inferior to strategy 4. It would appear that additional teaching and no self-learning is an adequate substitute for reduced teaching and self-learning after the teaching session. Strategy 2 certainly provides the best performance in situations where the access to computer technology is poor.

In the strategy 8, IMM programs were used as a self-paced learning package by the delegates. The slightly poorer performance overall in this strategy is a direct consequence of the performance in terms of essential skills (creative, visual literacy skills). This clearly indicates the value of teacher's intervention to improve essential skills.

Comparatively lower performance of the strategy 10 is mainly due to language barrier as Tamil officers used the CDROM produced in Sinhala language.

Comparatively lower performance of the strategy 11 is mainly due to use of regional agricultural trainers as facilitators for CDROM assisted training. The obvious factor in the particularly poor performance of this strategy is the fact that the teacher had only recently been exposed to the IMM program, and was not a media expert.

The strategies where assistance was not provided during the practical sessions include strategies 5, 7 and 9. As indicated in Figure 3, these strategies generally appear to have failed to perform adequately. The lack of assistance during the practical session is associated with the common, habitual mistakes (using unnecessary words, no letter thickness, problem of white space , small figures, *etc.*), difficulties in understanding the more complex and confusing issues covered by the IMM program (such as the use of bullet points).

Findings related to skills of the flip chart CDROM

The performance in terms of essential skills is lower than that for the desirable skills (Figure 3), meaning that the essential skills are determining the overall performance. There were four (4) essential skills tested for this training objective, three (3) of which are directly related to creative thinking and the visual literacy skills of participants. Although these three skills were elaborated using animations, text and key examples from previous charts, the capacity of the IMM program by itself to teach this type of creative element must be thrown into doubt. The particularly poor performance achieved by strategy 9 (IMM only with no assistance), lends further support to this doubt. The results suggest that even with a teaching input, the particular nature of this set of essential skills makes it unlikely that performance will improve without assistance during the practical sessions.

The best performance across the essential skills is observed in skill 3 (legible letters). Only 5% of the participants violated the measurable standards indicated in the performance test. It is interesting to note that the performance in this skill appears not to be influenced by the availability of assistance during the practical session. This skill reflects primarily a capability in the new Sinhala lettering technique. This particular skill is the most outstanding and effective feature, in terms of transferring knowledge and skills, of the flip chart IMM program. The excellent performance of participants in this regard, even using only the IMM program during practical sessions (strategies 5, 7 and 9), proves the capability of an IMM program to provide effective training in certain skills.

Strong performance for skills covered by the IMM program included 29 skills out of 60 skills identified for performance test. It could be concluded that any extension worker would be able to master these skills by using the CDROM as a self-learning training tool.

CONCLUSIONS

The main theme of this paper was to investigate and develop a training model based on 'high tech' to develop 'low tech'; CDROM technology to improve flip chart technology. High tech up to the level where facilities are available and low tech beyond that level (farmers level).

This paper described the development of a curriculum and a suitable delivery mechanism for flip chart technology. A series of recent case studies

undertaken in Sri Lanka, which trailed the CDROM's in various training scenarios, has been presented. The results indicated that CDROM technology utilising multimedia course ware alone (self-studying) is not effective at present. However, a more integrative approach to the use of interactive multimedia technology and few elements of conventional training methods (short discussion, minimum assistance for practical session, a presentation of individual flip charts at the end of the training *etc.*) are shown to produce a number of substantive improvements in this context.

The performance of strategies where assistance is provided during practical sessions has shown better performance than strategies where no such assistance is provided. Self-studying session before teaching is the most effective training strategy when considering the comprehension and retention of subject presented. Since the facilitator uses the selected parts of the IMM programs to support face to face training, involvement of trainer (media designer) for teaching could be reduced. This enables media designers to involve in audio-visual training without interrupting the hectic work load in media production.

Where limited computer facilities are available, use of whole CDROM as a teaching aid is the most appropriate strategy. This strategy, therefore, can be implemented in regional training centers where training programs are conducted under resource poor conditions.

Regional agricultural trainers and selected extension workers can provide effective audio-visual training at regional level, provided prior exposure to IMM training at a media centre. Therefore local extension personnel must be able to produce their own flip charts and organise multimedia campaigns, exhibitions, field days at regional level without any assistance of a central media unit. This is an achievable task, mainly due to graphic resources, examples of charts and the simple low cost technologies demonstrated in the CDROM to produce audio-visual aids.

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