Evaluation of illustration-based educational materials in El Salvador, Central America

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Abstract

While the use of printed materials containing illustrations is now less common in developed countries, its use is very important in developing countries, due to economical and technological constraints. However, educational materials used in extension programs in developing countries are usually prepared without taking in consideration the special characteristics of the local audiences. Those characteristics include language, gender, race, educational level, and other cultural factors that may affect the interpretation and understanding of the information transmitted through the educational materials. In this project small farmers in El Salvador-Central America, were questioned about their understanding of illustration-based educational materials. The findings show that the presence of text, color, and knowledge of the subject affect the interpretation of the illustrations by the farmers. Gender, educational level, and other socio-cultural characteristics affect the interpretation of the illustration-based materials. The importance of the evaluation of educational materials is confirmed, so the majority of the target audience understands them. The evaluation of these illustration-based materials was conducted to show the importance of including cultural factors in the development of materials based on an ontology.
Introduction

Worldwide, the number of illiterate adults in 2000 was 862 million. According to current trends, that number should drop to 824 million by the year 2010 (UNESCO 2002). The United Nations definition of a literate adult is a person aged 15 or over who can read and write (UNESCO 2000). In 1995, the literacy rates for El Salvador were 73% for males and 70% for females (UNESCO, 1995). The data highlights the necessity of alternative educational materials, which reduce the effects of illiteracy in the transmission of information. Most of the educational materials in developing countries, with few exceptions, are overwhelmingly print-oriented. In addition, most of the printed materials available are written at a level that makes them inaccessible to individuals with a low education (Hynak-Hankison, 1989; Stemmerman, 1991).

A computer tool to facilitate the production of illustration-based educational materials could make this task much easier and more effective. To accomplish this task, a group at the University of Florida’s Department of Agricultural and Biological Engineering is developing this tool and a series of educational materials in the areas of water management and irrigation (Cornejo, et al. 2004). The illustration-based materials that are being developed are audience-oriented (from here on referred to as localized). For example, if the illustrations are showing a Hispanic person for Latin America, this person can easily be changed to a Black person for African regions to make it more relevant to the local audience. Adjustments can be achieved just by selecting certain attributes from the database, without the necessity of creating a completely new drawing. However, the process of developing a product that meets audience needs, helps accomplish a teaching goal, or solves a problem, is sometimes challenging and may present hidden complexities (Bly, 1989). For the illustration-based materials to be useful, they were tested with a target population of low-resources small farmers in El Salvador, Central America.

![Map of El Salvador](image)

Figure 1. Map of El Salvador (CIA, 2004).

El Salvador is located in Central America its borders are with Guatemala to the northwest, Honduras to the northeast, and the Pacific Ocean to the south (Figure 1). From
around 1980, El Salvador was involved in a 12-year civil war, which cost about 75,000 lives. The war was brought to an end in 1992 when the government and leftist rebels signed a treaty that provided for military and political reforms.

El Salvador was selected for this study because of the social and agricultural conditions of the country. The adult literacy estimated rates are considered high – 70% in 2000 (UNESCO, 2002), and 80% in 2003 (CIA, 2004), with a difference of around 10% between men and women. Illiteracy is more noticeable among elder adults in rural areas, and especially, in the eastern regions of the country (Departments of San Miguel and La Union). Agricultural production in El Salvador is reduced and rudimentary. Most of the fresh fruits and vegetables that El Salvador consumes are imported from Guatemala and Honduras. The production is limited to staple foods like maize and beans.

Data Collection

The data collection in El Salvador was conducted during July 2004, with the support of PROMIPAC-El Zamorano (Integrated Pest Management Program for Central America) in El Salvador. To collect the data, personal interviews were conducted with 63 small farmers in five different communities: El Peñón, Huertas, Tunas, Singuil, and Pasacarrera. These “caserios” (groups of less than 50 families) were distributed in three departments, Santa Ana in the West, and San Miguel and La Union in the East.

The farmers that participated in the evaluation were part of the farmers’ field schools (FFS) in integrated pest management (IPM) supported by PROMIPAC. These schools meet once a week or once every two weeks for 3 to 5 hours. The topics where mainly focused upon crop production and integrated pest management (IPM). This is important to note since it could be reflected in some of the answers given in the evaluation process.

Literacy of Small Farmers in El Salvador

After analyzing the literacy data collected from the sample population (63), the values for women are above 80%, and for men are almost 90%.

Table 1. Literacy rates of small farmers in El Salvador.

<table>
<thead>
<tr>
<th>Individuals</th>
<th>%</th>
<th>Women</th>
<th>%</th>
<th>Men</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>8</td>
<td>13</td>
<td>3</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>Literate</td>
<td>55</td>
<td>87</td>
<td>15</td>
<td>83</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100</td>
<td>18</td>
<td>100</td>
<td>45</td>
</tr>
</tbody>
</table>

Source: Cornejo 2004.

Literate individuals had from 2 to 6 years of basic schooling, which is considered a low literacy level. Illiterates did not attend school at all. Illiterate people in this study were 30 years or older and 50% of them where 40 years or older. This shows a recent improvement in basic education in the rural areas. However, young people still withdraw early from school to help with the economic activities of the family. More than 60% of young adults interviewed in this study had only few years of basic education. The assessment of the literacy level of the sample population could be an important factor in determining how small farmers are able to understand the educational drawings.
Table 2. *Age groups of small farmers in El Salvador.*

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>Individuals</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>20-29</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>30-39</td>
<td>32</td>
<td>51</td>
</tr>
<tr>
<td>40-49</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>50+</td>
<td>13</td>
<td>21</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>63</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: Cornejo 2004.

**Purpose of the Paper**

The aim of field-testing the manuals was to identify the level of picture understanding by small farmers in El Salvador. It was important to demonstrate the necessity of testing illustration-based educational materials with a sample of the target audience before they are distributed to a larger population. As the need to develop publications for people with low educational levels continues to grow, so does the importance of special considerations in the content and design process (Ingram, et al. 2004). Audience background (i.e., culture, race) and experience should be considered in all phases of development of the materials. It is also important to understand the differences among people from different cultures, and to learn how people understand the message from educational materials based on drawings. As stated by Rohr-Röuendaal (1997), some people in Africa have never seen a picture or a drawing, and as a result, they are not used to interpreting illustrations as most other people do in everyday life (Clarkson and Johnson, 2001; and AMDM, 1997).

**Materials and Methods**

Rohr-Röuendaal (1997) highlights the necessity of evaluating educational materials; however, she also notices that this is more important when the educational drawings have been developed without direct participation of the final users. Since this work was a first step in the development of a tool to produce on-demand educational materials, the materials were developed away from the clientele; hence, it was important to test them.

The aim of this first field test of the manuals was to identify the level of understanding of the drawings by small farmers in El Salvador; gather their views on the value of the material, and to incorporate any additional material, alterations, or deletions, which would help the farmers to better understand the educational materials. The data collected from this evaluation process would be useful to understand how these specific farmers interpret the educational drawings, and what has to be included to make the manuals practical in a training process.

The sample population selected for this evaluation consisted of people with a low level of education or illiterates. Sixty-three small farmers from five different communities participated in the evaluation. All the farmers are participants of the Farmer Field Schools (FFS) in natural resources conservation, basic grains production, and Integrated Pest Management (IPM).
The questionnaire used in the evaluation contained a set of questions related to any previous training received by the farmer and specifically, to water management practices, and a set of questions on the illustration-based educational materials. In the second section the farmers had to evaluate the clarity of each picture, the message carried by the pictures, and the arrangement of the pictures explaining each activity. For example, the farmers were given five sets of materials (representing: contour planting, earth basins, rain and drainage, retention ditches, and stone lines). There was no oral explanation of the actions represented in each set of drawings to avoid influencing the answers. The questionnaire was developed at the University of Florida by professors with experience in extension work, and water management practices. The questions were evaluated in the field with 5 farmers and changes were maid to accommodate the questionnaire to make it more understandable.

The drawings to be evaluated were developed using scalable vector graphics (SVG) (W3C, 2004). Scalable vector graphics is a platform for development of two-dimensional graphics. Scalable Vector Graphics is used in many business areas including Web graphics, animation, user interfaces, graphics interchange, print and hardcopy output, mobile applications and high-quality design (W3C, 2004). This graphics language is an open source (royalty free) standard; it is based in the extensible markup language (XML), which was also developed by the World Wide Web Consortium (W3C, 2003). This allows the interoperability of SVG’s, as well as the use of this standard in conjunction with ontologies, and object-oriented databases. Further explanation on this topic is available via Cornejo et. al. (2004) and Badal et. al. (2004).

The interviews were conducted in groups of 5 or less people, since this facilitates greater participation and discussion among people. The data was collected individually for each farmer. The structured questionnaire consisted of 15 questions, some general questions about the local conditions relevant to agriculture, and water management practices. However, most of the questions were related to the educational drawings presented to the farmers for evaluation.

The educational drawings to be evaluated were grouped by topics. For example, the drawings related to contour planting were grouped together. The idea was to have a product representing all the steps of a process, similar to an educational manual. Five sets of drawings were presented to the farmers:

- Contour planting or farming
- Earth basins
- Rain and drainage
- Retention ditches
- Stone lines

The drawings were presented in black and white and color versions. This was done in order to compare if there is any significant difference in the interpretation of color versus black and white materials. Also, most of the printed educational material used in extension work is in black and white because it is less expensive than materials printed in color; and the availability of color printing technology is also limited.
Evaluation of Educational Drawings

The main objective of this work was to evaluate understanding by the farmers of the educational drawings developed for this project. If effective educational materials are to be developed then it is important that the information contained in those materials is conveyed to the audience (small farmers in this case). An important thing to consider during the evaluation is if the farmers have been familiar with any type of educational materials.

From Table 3, it can be noticed that 94% of the farmers had used text based educational materials. And all of the farmers interviewed have used some kind of educational material, including photographs and video, during different training opportunities. As for all the educational materials tested, 63 small farmers evaluated the drawings.

Table 3. Type of educational materials used by farmers in El Salvador.

<table>
<thead>
<tr>
<th>Educational Material</th>
<th>Have used this type of materials:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Individuals</td>
<td>Percentage of total sample</td>
</tr>
<tr>
<td>Posters</td>
<td>26</td>
<td>41</td>
</tr>
<tr>
<td>Text manuals</td>
<td>59</td>
<td>94</td>
</tr>
<tr>
<td>Photographs</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>Videos</td>
<td>7</td>
<td>11</td>
</tr>
</tbody>
</table>

Source: Cornejo 2004.

Contour Planting or Farming

Contour farming (Figure 2) consisted of a set of five drawings aimed to represent the use of contour planting. The objective was to show “contour” lines to the farmers evaluating the drawings. Since these are two-dimensional drawings, to show curves and differences in distance can be difficult (to enable proper perspective).

In these drawings, farmers identified the crop as being sorghum (Figure 2). The farmers at first were more interested in the crop variety, and trying to identify the other objects resembling plants. Some of the farmers said that “A” was a weed or an aloe plant,
and that “B” were eggs laid by some insects, as seen in figure 2. These interpretations confirm the recommendations given by Rohr-Röuendaal (1997), that the drawings should be keep simple, and that all unnecessary details should be avoided. This eliminates wrong interpretations, and it helps people focus in the main aspects of the drawings. Mainly, the objects that transmit the message that needs to be conveyed.

Slightly more than 56% of the farmers identify the drawings as representing contour planting. Nevertheless, all of the people interviewed recognized them as some type of drainage or land conservation practice. However, it is worth noting that all the farmers had had some training in land conservation practices given by different organizations, according to what the farmers said during the interview process.

Another drawing in this set shows a field without contour planting or any other practice to reduce soil erosion or promote water conservation. In the black and white version, farmers identified the runoff “C” sometimes as water and in some cases as soil or mud. In the color version, the water “C” was easily identified as such. This demonstrates the important that colors may have in the interpretation of illustrations.

**Earth Basins**

In the second set of drawings, representing earth basin construction, again some of the farmers were more concerned about the type of plant presented to them in the drawing. The origin of this problem could be that no explanation was given about the drawings, since that could influence the answers during evaluation, and the plants are of main interest to the farmer.

From the size of the plants (A) the farmers determined that some vegetables were grown (Figure 3) in the field. Then, the answers to the evaluation were related to vegetable production, like land preparation and planting of seedlings.

Most of the farmers did not have any problem identifying the plantain or banana tree (B). They also identify this practice as the use of intercropping. The object representing the water retained in the basins was easily recognized in the materials presented in colors. When presented in black and white, the farmers interpreted it as soil, mulch, and humid soil. It can be concluded that the color drawing was quite important for proper interpretation as it was in Figure 2.

Figure 3. Drawing representing earth basins, evaluated in El Salvador, 2004.
None of the farmers interviewed recognized the use of earth basins for water retention. However, it is important to clarify that these educational drawings are not intended to be used by themselves, but as a reinforcement of a comprehensive educational program, with the respective explanations. These materials should be intended to be used as an aid to the farmers to remember the information given during more extensive trainings.

A main problem in this and other manuals is how to correctly represent actions being performed by people. Since movement is hard to represent in static graphics, the posture of the person in the graphic could help to represent movement. More work is needed in this area, to find a better way to represent movement and actions in the drawings.

**Rain and Drainage**

Two of the most difficult things to represent in drawings are abstract ideas and objects with changing scale or relative size. As a result, the drawings in figure 4 were included in the evaluation. With the exception of a few farmers, the majority recognized the entire sequence of drawings, from cloud formation to the rain, to the damage to the crop. Only one farmer interpreted the damaged crop (A) as being caterpillars, and this was in the black and white copies. The respondents even noticed the water running through the furrows (B).

![Figure 4. Drawing representing rain and drainage, evaluated in El Salvador, 2004.](image)

**Retention Ditches**

This set of drawings represents the use of ditches to collect rain water (runoff) and retain irrigation water in the dry season (figure 5), as well as to serve as drainage during the rainy season. Some farmers confused the ditch or channel (A) with a road.

This shows the problem in representing three-dimensional objects in a two-dimensional drawing. This could also be a scale problem, and maybe showing a larger field would help in the interpretation of these drawings. A possible solution would be the use of shadows and colors to accentuate the features of objects such as this. With the black and white examples of this manual, farmers had problems recognizing the water (B) flowing in the ditch.
There were two problems with how the farmers interpreted this set of drawings (Figure 6). First, they thought that the line or barrier of trees (A) was a caterpillar. Second, they identified the stones (B) that try to represent a barrier (terrace) as insects’ eggs. Those answers could be related to the training that the participants were recently receiving in integrated pest management. Nevertheless, the farmers that have received training in soil conservation didn’t have too much problem recognizing the objectives of these drawings.

That means that with some explanation, these drawings easily could serve as materials for recollection of more comprehensive training as it was intended. This point is important, because it helps to highlight that no educational tool is intended to be used alone. These illustration-based materials are designed to complement the training given by an extension agent, within a well structured educational program. They are intended as a tool that will help the farmers to remember the concepts learned during the training sessions.

All the manuals use connectors to join one drawing to the next. The idea is that those connectors can show the flow of the idea that the drawings are trying to convey to the
The figures used to represent connectors in the manuals are presented in Figure 7. A dice, an arrow, pointing hand, sticks, and numbers were tested.

![Figure 7. Drawing in El Salvador, 2004.](image)

Different connection symbols were evaluated for use in the tested manuals. The majority of farmers that could not read selected the hands, the dice and lines or sticks. However, there was some confusion with the pointing hands, and arrows. Some farmers thought that arrows and/or hands were being used to point at something specific in the drawings. The people that could read selected the numbers, and lines or sticks as a way to denote order (Table 7). It is also important to notice that farmers in El Salvador have had contact with multiple types of educational materials and did not fit the literature model of farmers from some regions of Africa's (Rohr-Röuendaal, 1997).

<table>
<thead>
<tr>
<th>Signs</th>
<th>Individuals</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hands</td>
<td>17</td>
<td>27</td>
</tr>
<tr>
<td>Arrows</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>Dice</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Lines</td>
<td>17</td>
<td>27</td>
</tr>
<tr>
<td>Numbers</td>
<td>14</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Cornejo 2004.

**Table 4. Drawings’ connectors selected by farmers in El Salvador.**

**Results and Conclusions**

Most of the farmers were able to recognize the objects and actions presented in the illustrations. However, some details were difficult to recognize, for example, rows of stones in a barrier were frequently confused with insects’ eggs. Also, a line of trees was misinterpreted as a caterpillar. Recent training in Integrated Pest Management conducted with some groups, could have contributed to this interpretation. Interestingly, illiterate farmers often asked for some text to be included with the drawings. The reason was that they could ask their children or neighbors to read the text, and that would help them remember the information. It was also observed that the majority of the farmers tend to focus on small details (i.e., shoes of the person, variety of the plants) that are not relevant to the educational message of the materials. It was concluded that caution is needed when including such details since people who produce the materials might not consider important.

All of the farmers that participated in the evaluation process were asked to give their comments in the overall quality and usefulness of the drawings. It is interesting to note that the great majority of farmers who had a problem with understanding a large part or the whole manual were women. Women constituted around 27% of the participants. We can speculate that this could be associated with the limited participation of women in training related to agricultural practices and technologies. Most of the training targeting women in the areas in
El Salvador is focused towards commercialization of agricultural produce, and other household activities. A common recommendation given by the farmers was to use colors instead of black and white drawings. As stated earlier both color and black and white drawings were evaluated. Farmers stated that colors would facilitate the recognition of some features as crops, water versus soil, and insects. However, when the educational materials are to be developed in field offices by training agents, the availability of color printers or copiers is limited, and in most cases, when available, the costs are still prohibitive for most training programs in developing countries. The manuals were printed in 22.5 cm x 28 cm (8.5 in x 11 in) paper with four frames per page. Some farmers with vision problems recommended the use of larger drawings. Again, this shows the necessity of considering all the factors that could improve the perception of the educational message.

The most relevant comment is that all the farmers prefer to have text explaining the actions shown in the drawings. Even the people with lower levels of formal education and illiterates supported this – as these farmers stated that their children or a neighbor could read to them. Also the farmers confirmed the notion that the manuals need to be accompanied by an explanation of the processes being represented. Manuals presented without any explanation often would lead to misinterpretation and confusion. This can carry serious consequences depending on the topic of the educational materials (i.e., agrichemicals and toxic material applications).

**Educational importance, implications, and application**

With the number of illiterates still high worldwide, and most of them being farmers in developing countries (UNESCO, 2002), there is a necessity of alternatives to text-based educational materials. The use of illustration-based materials is not new. However, they are usually not relevant to the specific characteristics of the target audience, or have not been tested to assess how well they are understood.

This project has confirmed the necessity of evaluating educational materials to be used in the training of farmers with low levels of formal education. Good illustration-based materials have to be understood by the audience to be considered useful, and the only way of assuring this is through the use of field evaluation. Too often extension program specialists ignore this fact and produce educational materials that are not well-suited for the specific conditions of the farmers.

The evaluation of educational materials performed in El Salvador, will improve the quality of the materials developed using a computer tool for production of personalized illustration-based extension manuals (Cornejo et al., 2004). It will also allow the development of evaluation guidelines for educational materials produced using this new tool. This will enable the inclusion of variables like language, culture, gender, and other factors that affect how the farmers interpret and accept the information provided using educational materials.

The types of educational materials presented here are not only important for farmers in developing countries but also in developed nations. Miller (2001) states that in the order of 40 million Americans age 16 years and older have low literacy skills (U.S. Congress, Office of Technology Assessment, 1993). Moreover, the importance of the evaluation of educational materials and the development of new tools to produce them is not limited to agriculture; they could be applied to the education of children, and adults with disabilities.
Acknowledgements

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