Impact of a LOGO Program on Native Adults

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and
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Abstract

This paper examines some of the important research related to Seymour Papert's LOGO computer program. Drawing upon the review of the current research, in an original exploratory research project involving second year university students of native origin, the authors attempt to come to some general conclusions about the applicability of LOGO in educational settings. In addition, the possible use of LOGO in Third World countries is examined and discussed.

Introduction

The LOGO computer program has been developed by the MIT LOGO Group over the past number of years. Seymour Papert has been the most dominant force within the Group (Papert, 1972a, 1972b, 1972c, 1980; Papert & Solomon, 1972), and, in fact, is generally credited with the marriage of the Piagetian and cybernetic concepts which have led to the birth of LOGO (Groen, 1978; Larivee & Michaud, 1980).

LOGO was originally created by Papert for children; consequently, it incorporated an easy to learn, but rich and expandable, vocabulary to reflect such key computer science ideas as local and global variables, naming, recursion, and procedurization. Having developed LOGO for children, Papert and his colleagues then looked to it as a provider of an evironment in which a subject could learn by doing, and by thinking about what he/she had done, develop "great ideas" in the Piagetian sense (Papert, 1980).

The interest in LOGO as a research tool was immediate and varied. Since its development, LOGO has been used with students of all ages (including those at graduate schools; it has also been tried with the physically handicapped, the learning disabled, the emotionally disturbed, the gifted, and the delinquent (Watt, 1982). In educational settings, the research has ranged from providing an environment for experiential learning of mathematics to the formation of a foundation for a new type of school based on Piagetian approaches to teaching and learning, using computers. Although it is clear that something important has happened here, the exact role that LOGO and its related activities have to play has not yet been fully delineated. Groen (1978) in his article on Piaget stated that while LOGO was a well defined environment, it was unclear as to what should be done with it. The literature appears to bear out this assertion.

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Review of the Literature

Each time LOGO has been used for researches purposes, certain objectives have been emphasized and others ignored. Some studies, for example, emphasized an observational or case study approach (e.g. Watt, 1982; Solomon and Papert, 1976; Lawler, 1980); others attempted to include an objective measurement component (e.g. Milner, 1973; Statz, 1973; Howe, O'Shea, and Plane, 1974). The general conclusion reached by most of the studies was that the full potential of LOGO had not been realized and that more diverse research was needed.

The literature further indicated that during the last few years the use of LOGO in the schools had increased dramatically. For the most part, studies have concentrated on problem solving and mathematical skills. In general, research into the effects of LOGO on mathematical skills have been disappointing. For example, Milner (1973) found LOGO did little to change grade five mathematical skills or concepts. Howe, O'Shea, and Plane (1974). in a very elaborate study at Edinburg, found that, although the LOGO group scored higher on a test of general mathematics, the control group scored significantly higher on a mathematics attainment test. Statz –(1973), expanded her study to investigate the effect LOGO had on the acquisition of certain computer-related concepts by children. She tested six hypothesis related to the concepts of procedure, recursion, variables, conditionals, & editing and found that the LOGO students scored better on only the recursion aspect of the study. And finally, in a study using grade five subjects, Seidman (1981) found that there were no significant differences between his LOGO and his control subjects, using traditional conditional reasoning tests; however, he did report that the LOGO groups scored consistently higher on tests measuring the inversion-fallacy principle, leading him to speculate that LOGO might be inversion specific.

Perhaps more interesting was Seidman's (1981) discovery that the control group scored significantly higher on a post-test using a standarized reading achievement test. Although the reasons for these startling results are not clear, the possible educational implications of the above results, if they are proven correct, are obvious and important.

If the results based on objective data are inconclusive, the opposite appears to be true when one considers the observational data. Virtually all of the studies (Milner, 1973; Seidman, 1981; Abelson et al., 1976; Watt, 1979, 1982; Solomon and Papert, 1976; Weir, 1979) agree that LOGO does improve a subject's reasoning and problem solving skills. Howe, O'Shea, Plane (1974), for example, reported that LOGO subjects discussed and argued more sensibly. Milner (1973) indicated that teachers reported better problem-solving strategies used by the LOGO groups. Other studies (Watt, 1982; Goldstein and Miller, 1976) basically echoed the same ideas.

As mentioned earlier, LOGO has also been used with a variety of special populations. LOGO has been used with handicapped and learning disabled students (Weir, 1979; Watt and Weir, 1981; Papert and Weir, 1978) with some encouraging results. And Austin (1976) concentrated on teaching teachers LOGO programming, finding in general that teachers were less willing to try new ideas than children.

Another rather interesting approach using LOGO has been advocated by Larivee. Drawing on his doctoral work with Piaget on the subject of delinquent children, Larivee has come to the conclusion that LOGO may be used as a therapeutic tool with juvenile delinquents. Noting that deliquents are often concrete operational thinkers and incapable of either seeing or resolving contradictions, Larivee and his collaborators (Larivee and Michaud, 1980; Larivee and Gendreau, 1980; Larivee, 1979, 1980, 1981) have suggested that the LOGO program be used in conjunction with traditional therapy to hasten the therapeutic process with juvenile deliquents. Larivee hypothesized that becoming a formal operational thinker (via LOGO) capable of abstract and retroactive thinking, would lead to a quicker and more complete readaptation.

One can draw several conclusions from these diverse studies. Although satisfactory objective data appears to be lacking, observational data suggests that LOGO can be effective with most populations. Another conclusion one can draw comes from the experiences of the Brookline Project (Howe, O'Shea, & Plane, 1974), showing that teacher training and availability of resource materials are absolutely critical to the success of any LOGO project. This, in turn, brings restraining economic considerations to the forefront, and perhaps contradicts the somewhat idealistic picture of the future given to us by Papert (1980).

THE LOGO PROJECT

Method

Interest in the LOGO program led to the establishment of an exploratory research project using second-year university students of native ancestry. Since LOGO was expected to influence students' reasoning processes, it was decided to incorporate a LOGO-based component in one of the courses being taught. The impact of LOGO on the students was monitored closely using both personal interviews and a formal test.

The course itself was a required component in the second year teacher training program for native students. Students were told that the course had been expanded to include a unit on Apple LOGO, and that, although the unit was optional, completion of the unit would be weighted in the final grade. All 15 students decided to participate in the LOGO project, although one student was later excluded for health reasons. Students were then given a brief introduction to LOGO in a lecture setting prior to their first computer session. The first computer session for each student was closely supervised by one of the authors and involved an introduction to the Apple micro-computer, LOGO, and the LOGO manual. Students were then encouraged to work through the manual on their own.

The ten hours each student spent working on LOGO was directed toward the completion of four tasks: acquisition of skills in LOGO, completion of a procedure involving recursion, completion of a game project, and completion of an original graphics project. Although the instructor answered LOGO questions during classes and some assistance was available in the computer lab, students generally were responsible for completing the LOGO unit on their own. Four students, after completing the first terminal session, decided to drop out of the project. The remaining ten students who completed the project averaged 7 computer sessions each. Computer sessions typically lasted 1½ hours.

The Results

A major advantage of LOGO is its purported impact on reasoning strategies (Papert, 1980). It was hypothesized that native students would be similar to other comparable students; that is, some of them would be functioning at Piaget's concrete or transitional stage (Birnie & Michayluk, 1979). It was hoped that participation in the LOGO project would facilitate development of formal strategies. In order to monitor the potential impact of LOGO, the Logical Reasoning Test (Burney, 1974) was administered to the students both prior to and on completion of the LOGO project. The time between tests was 11 weeks.

The Logical Reasoning Tests purports to roughly categorize students as Concrete (0-7), Transitional (8-13), or Formal (14-21). Of the ten students completing the project, five were categorized as formal on the first testing, three as transitional and two were classed as concrete thinkers. The four subjects who withdrew from the study were all classified as concrete or transitional thinkers.

The results of both tests are reported in Table I. As anticipated, students became slightly more formal in their reasoning and thinking during the course of the project.

TABLE I

SUMMARY OF LOGICAL REASONING DATA
(N = 10)

Measure	Mean	Standard Deviation
Log Reas T1	11.2	3.88
Log Reas T2	12.9	3.07
		t = 2.55
		(df = 9, p < .05)
No. LOGO Files	7.00	4.64

Correlations

	Log Reas 2	No. Files
Log Reas 1	.841	.469
Log Reas 2		.623

Discussion

The experimental methodology used in this project is inadequate to attribute the favourable results to LOGO. Not only was the sample size small, there was also no attempt to control for a variety of factors including selection, maturation and testing. Nonetheless, it is reasonable to suspect that the LOGO experience, or at least the computer contact, favourably influenced the students' reasoning strategies. This suspicion was further supported by student comments during interviews. Students completing the project unanimously stated that the exposure to LOGO changed the way they approached problem solving and reasoning. The two computer concepts most often mentioned in connection with these statements were "editing" and "de-bugging". As well, students reacted positively to the individual nature LOGO. Some learned the concepts faster than others and very quickly became tutors for the ones still having difficulties.

It might be of interest to the reader to know that the authors **observed** a relationship between the first Logical Reasoning Test scores and ability to understand computer concepts explained during the training sessions. Most of the subjects with concrete and transitional scores had some difficulties in understanding how the turtle worked; several showed signs of actual frustration, and, eventually dropped out.

The number and complexity of files saved by each student was also monitored. In general, students saved a file after each computer session. Average number of files was 7 (S.D. = 4.54). Although the correlation between number of files saved and Logical Reasoning (Post) appears large, it was not significant (Table I). A review of the students' files revealed that they adhered closely to the LOGO manual for most of their procedures. With one exception, the final graphics projects were simplistic in nature, consisting of trucks, apartment buildings and similar block shapes. The one exception, by a male student who coincidentally scored highest on the Logical Reasoning Test on both occasions, consisted of a complex, detailed bicycle.

Some General Conclusions

1) LOGO is a language for learning; it is also a language for learning to think. Because of this, the authors have come to the general conclusion, based on the literature and this project, that LOGO can be effective for most students in an educational setting. In fact, students who were previously unsuccessful in school,

might experience success with LOGO (Watt, 1982). Another positive element related to interaction has led to students themselves taking on significant roles as teachers of other students. This was evident in the native student project mentioned earlier; the students who "caught-on" first, aided the others.

2) LOGO is designed to make computer programming as easy as possible to understand. For this reason, LOGO is an effective program for teaching and achieving computer literacy. The problem here is where does one go after attaining computer literacy? This was a question asked by the native students in this project. They exhibited some confusion as to what they should do next in the micro-computer world into which they were introduced by LOGO.

3) As mentioned earlier, to be effective, teacher preparation and availability of LOGO materials is critical. Establishing a properly run LOGO project could become quite costly and time consuming, and, perhaps, beyond the financial means of some jurisdictions. If one combines the cost factor with the general weakness of the object data, researchers may find that LOGO as an educational tool, may be difficult to sell to administrators.

4) On the surface, LOGO appears ideal for introduction into the Third World. Easy to use and interesting, it seems an ideal way to introduce computer technology into developing countries. One of the problems, however, seems to be one of cost. As indicated above, LOGO projects might be quite expensive to operate. One is also reminded of Nehru's statement to the effect that it is insulting to talk of aesthetics and culture to a population which is starving. Similarly, it may be just as insulting to speak of high technology to comparable populations. The idea of LOGO in the Third World, no matter how attractive on the surface, should be carefully studied to decide whether or not money spent on LOGO there is indeed the best use of resources.

Another problem associated with introducing LOGO into developing countries has to do with the impact of industrialized educational technology on any culture. Pena (1983) points out that one of the reasons why educational technology has failed in Latin America is that educators did not take this impact of technology into account. He further points out that the impact of technology (such as computers) has been more seriously disruptive in dependent Third World Societies because these societies, instead of having evolved and developed at their own natural rate, have developed as a result of forced updating from the outside. This has tended to turn them into dependent people who do not live for themselves but for others. It seems apparent that if LOGO, an industrialized technological development, is to be applicable in the Third World, then it has to be modified to incorporate valuable contributions already existing in the various cultures. This was a sentiment echoed by several of the native students in the LOGO project described in this paper; they expressed discomfort, even conflict, with a technology for which they were not prepared by their culture. As Pena (1983) stresses, change in the Third World will have to evolve slowly and start from what already exists, in spite of the apparent urgency. The ending to his paper seems an appropriate one for this paper:

> A development built on the principle that technology is an autonomous reality, whose rationality must be imposed on the people, is utterly false. The technology which could open roads of educational transformation in Latin America would be that which manages to establish a balance between the modernization thrust undoubtedly required by education and the system of values of the people whose lives are affected deeply by the technological innovations.
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> (Penna, 1983, p. 20)

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LOVE'S LABOUR'S LOST

A Primer for Educational Technologists

By Dr. Denis Hlynka, Editor, CJEC

The AMTEC 1984 conference entertainment night on Tuesday June 17 features a visit to Canada's famed Stratford theatre to see William Shakespeare's early comedy, Love's Labour's Lost. For AMTEC members who may not have had time to "brush up their Shakespeare", to borrow from Cole Porter, we offer the following commentary and summary.

Of course, it would really seem stretching a point too much to claim that LOVE'S LABOUR'S LOST was just the right play for educational technologists, yet oddly, we can *almost* make just such an assertion.

* * *

A contemporary theme in educational technology today involves the relationship of scientific and/or aesthetic methodologies towards improved practice in our field. Most notably, Ivor Davies has argued for a three-stage definition of educational technology which he calls ET-1, an "audiovisual" approach; ET-2, a "systematic" approach, and ET-3, a wholistic, Gestalt, aesthetic, or "systemic" approach.

The dichotomous theme of science vs art is not a new one. Medieval historians note the concern in England of the 11th century that pollution was swallowing the city of London. The pollution referred to was smoke pollution from the burning of wood, a problem which simultaneously threatened to deplete the major forests of the country.

The great exposition of 1851 in London created the Crystal Palace as the ultimate technological symbol, while in 1889 Alexander Eiffel designed the competing French symbol for the Paris Exposition of that year, now known as the Eiffel tower, and symbolizing man's ability to conquer the world through technology.

Reaction set in as first expressed by Henry Adams in "The Virgin and the Dynamo" in which he metaphorically contrasted images of Christianity with those of an industrialized society.

Art, too, reflected "the shock of the new" in multitudinous ways, in the works of Picasso, Braque, Cezanne . . . and then a flood of "isms" as modern art attempted to come to terms with technology. Music changed from romanticism to a stumbling mechanistic exploration of the technological world: Honnegger in France wrote PACIFIC 231, a tone poem rhapsodizing over a steam engine; Meitus in Ukraine wrote DNIEPER DAM, which musically illustrated the digging of the foundations for the great hydroelectric station built in Ukraine in 1932 at Zaporyzhya.

Contemporary analysis of the art/science question is commonly dated to C.P. Snow's analysis of "The Two Cultures", a debate which appears not to have subsided.

And in education, as recently as April of 1984, the prestigious education journal Phi Delta Kappan posed the same dichotomy within an educational perspective: Will educational research inform practice?

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It has been said that there is an answer to everything in Shakespeare, and so, it is perhaps not surprising that the theme of LOVE'S LABOUR'S LOST is precisely that same art/science dichotomy. For Shakespeare, "art" is methaphorically represented by love; "science" is learning, education, or simply, study. Thus we have a tale which places love and education in counterpoint against each other.

Three attitudes towards love are identified. The men from Navarre believe that love can be controlled, and even ignored. Indeed, they determine to spend three years in study, away from the society of ladies. The ladies show a second attitude. They feel that love cannot be denied. And the third view is that of physical love, represented by the characters of Don Armando, Jaquenetta, and Costard.

The play also suggests two attitudes towards study. First, study is perceived as a tough rigorous discipline. Study is abstract, and not relevant to the everyday world. The world of Academe has no room for frivolity. Yet study will "make us heirs of all eternity."

When most of the characters in the play find this view untenable, Biron suggests, with a flourish of philosophic logic, that the truest study is to be found in a woman's eyes. "For where is any author in the world teaches such beauty as a woman's eye?" True education needs true love.

THE MAJOR CHARACTERS:

KING FERDINAND OF NAVARRE.
BIRON, LONNAVILLE, AND DUMAIN. Gentlemen of Navarre.
DON ADRIANO. A pedantic fool.
COSTARD and MOTH. Clown and page, respectively.
THE PRINCESS, ROSALINE, KATHERINE, AND MARIA. Counterparts to Biron, Lonnaville, and Dumain.

THE STORY

Act I. King Ferdinand of Navarre and his three close friends have determined to spend the next three years in study. This means no pleasures, no "huge army of the world's desires," and most of all, no ladies. Biron, one of the three, hesitates, suggesting that the oath will be hard to keep. Also, he points out, the Princess of France and her train are to visit shortly. Then we shall make an exception, proclaims the king. No! says Biron, and he promptly signs the oath!

Now a series of comic characters are introduced. Dull, the constable has caught Costard the rustic with Jaquenetta the dairymaid. A letter accusing Costard, has been written, full of "fire-new words", by Don Adriano. Indeed, everyone seems to misuse words. The king selects the punishment . . . Costard must fast. Later, in the final scene of act one, Don Armando reveals that he is in love with Jaquenetta; she in her turn, is overwhelmed by his apparent erudition.

Act II. The princess of France and her ladies now arrive. She soon finds out that each of them is in love with one of the King's nobles: Rosaline loves Biron, Katherine loves Dumain, and Maria loves Longaville. Because of the oath, the ladies are not allowed indoors. Instead the King and his three

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COMPUTER NEWS
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New Software Evaluation Instrument

The National Science Teachers Association (NSTA) has published a new Microcomputer Software Evaluation Instrument. Prepared by the NSTA Task Force on Assessing Computer-Augmented Science Instructional Materials the new instrument is designed to be used primarily in school-level or district-level evaluations of science instructional software packages.

The eight-page instrument appears in the January 1984 issues of NSTA's perodicals, *The Science Teacher, Science and Children and the Journal of College Science Teaching.* Copies may also be obtained from NSTA, 1742 Connecticut Avenue NW, Washington, DC 20009.

For more information, contact Leopold E. Klopfer, Prof. of Educ., Chair, NSTA Task Force, Univ. of Pittsburgh, LRDC Bldg., 3939 O'Hara St., Pittsburgh, PA 15260. 412/624-4821.

Free Access to On-Line Software Library Offered by Searchmart

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FORMATIVE RESEARCH
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mance statistics were not compiled. Further, the system did not allow the direct entry of text or numeric responses to a question posed in a sequence: the user could only enter page numbers through a numeric key pad. Of course, these problems are not endemic to Telidon, whose graphic system can be adapted to different host computing facilities and technical configurations. However, they alert the developers of Telidon systems to the need to ensure that any computer-assisted instruction sequences are sufficiently flexible in design and powerful in computing ability to compete with other available systems.

3.5 Learning Impact

A preliminary evaluation of one computer-assisted instructional sequence suggested that certain Telidon sequences may be effective for some students and ineffective for others. In this study more advanced students learned as well from Telidon as from a traditional teacher presentation. However, students in general-level classes who learned from Telidon tended to score less well on learning tests than students taught by a teacher. The sequence studied covered a small portion of the grade 9 mathematics curriculum and allowed students to go through the material without teacher assistance. Though this study could not employ complete controls on all related variables, these findings indicate that educational sequences must be designed with careful consideration of how and with whom they will be used.

3.6 Designing Sequences

Findings on the role of graphics and the possible differential impact of sequences were combined with sequence creators' comments to provide suggestions for the development of effective sequences. For instance, teamwork in creation, such as matching educators with graphic designers, may be one way to keep sequences properly targeted and avoid an overemphasis on any aspect of a sequence. Pre-testing sequences with target users would also be effective in sharpening the design and avoiding possible misuse of a sequence. In order to maximize the use of the database, some form of need assessment should also precede the creation of sequences.

FORMATIVE EVALUATION AND THE TELIDON FIELD TRIAL

A substantial body of research is finally emerging in the wake of the enthusiasm for educational applications of the new videotex technologies. Researchers are beginning to examine the antecedents, applications, and effects of these new systems. One important type of research is applied formative research, which can affect planning and development directly.

The field trial explored the potentials of Telidon technology as an educational tool. It also provided the opportunity for the formative research to be conducted. We hope that the findings and recommendations will be useful for researchers and practitioners working with Telidon and other innovative educational technology.

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LOVE'S LABOUR'S LOST
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companions come out to meet the ladies outdoors. Negotiation and bargaining follows, but some essential papers have apparently not arrived, so the princess and her ladies must stay the night. The negotiations are firm, but towards the end it is obvious that the king is quite taken by the Princess.

Act III. Don Armando is in love . . . with the dairy maid. He asks his page to sing for him. A verbal duel between Moth and Don Armando discusses love, and the dairymaid's probable virtue. Finally Don Armando, desperately in love, determines to release Costard from his custody, so that Costard will deliver a message to his love.

Enter Biron. He too, apparently is in love, (Isn't everybody?) and he gives Costard another letter, destined for Rosaline. Thus Shakespeare contrasts the physical passion on the one hand, with true, honest love, on the other. And Costard now has *two* letters to deliver.

Act IV. There are three scenes in this act. The princess and her ladies are going shooting in the forest, when they are interrupted by Costard carrying the love letter meant for Rosaline. The princess asks that the letter be read aloud. It is full of pomposity. And, it is, of course, the wrong letter.

The second scene introduces two new characters, the school teacher and the curate. Jacquenetta enters with her letter. Since she is illiterate, she asks the curate to read it for her, which he does, and which the school teacher is able to promptly criticise. Again it is the wrong letter, which the characters note, and so they send Jaquenetta to the king!

Scene three. Biron is rediculed by the King, Longaville, and Dumain who see that Biron is the first to break his oath. In a quick philosophic flourish, Biron explains that the only real books are the eyes of the ladies! argument is enthusiasticlly accepted, and the four determine to go off and study what should be studied!

> "For women's eyes this doctrine I derive:
> They are the books, the arts, the academes,
> That show, contain, and nourish all the world."

Act V. More fun is made of jargon and pedantry as the schoolmaster, the curate, the constable, and Don Armando go at each other full tilt. Moth epitomizes the jargonistic humor in which all indulge, saying that "They have been at a great feast of languages, and stolen the scraps." But it is Costard who ultimately produces the longest word of them all, probably good enough to enter the *Guiness Book of Records* . . . Honorificabilitudinitatibus.

The final scene returns us to the princess and her ladies. All have received gifts from their admirers. Upon hearing from their page that the men are about to make an appearance dressed in Muscovite costume, the ladies determine to disguise themselves. Indeed, the "Muscovites" woo the wrong girls! The humorous Pagent of the Nine Worthies follows as entertainment. Suddenly the merriment is broken as Don Armando is accused of getting Jacquenetta pregnant. And more bad news arrives. The King of France is dead. The princess resolves to return home immediately. The men all proclaim their intentions but the ladies decide to make their lovers wait a full year before they will marry them. Even Don Armando will have to prove himself . . . he will spend three years trying to be a farmer! And so, as the play comes to an end, love has been proclaimed, but, at least a year must pass before any marriages will take place. Indeed, for the moment at least, love's labour had been lost.

We began our discussion with a look at the art/science dichotomy so often cropping up in educational technology of the 1980's. We have concluded with Shakespeare's metaphoric analysis in terms of love and study. Who wins? Shakespeare is predictably ambiguous. Perhaps we should be the same. Educational technology is more than a concept; it is a state of mind. And educational technologists will appreciate that in Love's Labour's Lost, the master playwrite is . . . just possibly . . . speaking to us.

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MEDIA NEWS

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Multimedia for Manitoba?

An association for multi-image in Manitoba is in the process of being established. Those interested, or those in other provinces belonging to similar associations with ideas which might help the fledgeling organization, are invited to contact Cliff Kehler, c/o Inland AV, 1645 St. James St., Winnipeg, R3H 0X1. □