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ABSTRACT

Videotape and closed circuit instructional television (ITV) have been used for training Internal Revenue Service agents, and its use should be expanded. Experiments show that for every hour of conventional instruction converted to ITV a 25% time savings with equal or increased learning effectiveness can be expected. Although the capital cost of about $100,000 for building and operating a production facility is high, estimates show the full cost would be offset by savings in the first year of use. Recommended studio equipment includes two Raytheon 500 cameras and two Ampex videotape recorders for a total cost of $57,000. The basic field system should include an Ampex videotape recorder and camera, three TV monitors, three microphones, and an audio mixer for a total cost of $3,150. Additions to the basic field unit could raise the field unit price to approximately $8,000. Minimum personnel needs are a television instructor working full time and producing one hour of programming per week, and a full-time producer/director to work on methods and production. (MG)

TELEVISION REPORT #3

Methods Section
Internal Revenue Service
March, 1969

INTRODUCTION

We have now reached the third anniversary of the operation of a closed circuit television (CCTV) system at the National Training Center. During these three years we have seen the emphasis on the use of television grow and shift, both in our own classrooms and in the field of education and training in general. Starting from the base of television as a tool for more effective interpersonal skills training we have now advanced to the point where we see instructional television (ITV) as a necessary module of a complete training system. As an integral part of our training system ITV will be one of several instructional media available to the course designer.

In this paper we will discuss the potential for economical, efficient, effective utlization of television as a presentation medium. We want to stress that this or any media cannot work magic; that is why we concentrate on software. The computer term GIGO, "garbage in, garbage out" can aptly be applied to most unsuccessful uses of ITV. Instructional television is too costly and has too much potential to risk GIGO (Murphy and Gross 1966).

We know that the success of efficient training programs depends partially on our ability to provide a uniformity of instruction, Servicewide. It is also dependent on our ability to transmit information to trainees economically and effectively. This paper contains our conclusions on how a Servicewide television system can meet some of these needs and our plans for implementation of this system. We wish to acknowledge the contributions of the following in helping us gather data and form conclusions:

Actron Corporation

DAVI

NAEB

Navy Photographic Center - TV Branch

SUMMARY OF USE OF TELEVISION IN IRS TRAINING

To date, NTC had used its television system for interpersonal skills training, dissemination of information, and presentation of knowledge (ITV). The most extensive use has been in the interpersonal skills area--role playing, communications training, and instructor training; much of this training is of a type that would not be feasible without TV hardware. Our efforts in the area of ITV have been successful but severely limited due to the inadequacy of our present hardware and the lack of playback capability in the field. However, we see this as the area that will have the largest payoff. We now possess or can readily develop the software capability for extensive ITV programming when acquistion of hardware makes production and reception feasible.

ANALYSIS OF POTENTIAL ROLE OF TV IN IRS TRAINING

A partial analysis of existing courses has shown a definite potential for ITV software. These are examples only and a further analysis would certainly reveal more areas of consideration. A summary of the findings follows:

Revenue Officer Phase I - 200 hours total

- 47 hours identified as appropriate for telelessons*

Revenue Agent Basic Course (Part I, Book I Individual, Partnership, and Simple Corporation) - 69 hours total

- 55.25 hours identified as appropriate for telelessons*

Advance Income Tax Law for Tax Technicians - 144 hours

- 49 hours identified as appropriate for telelessons*

(See appendix 1 for detailed breakdown)

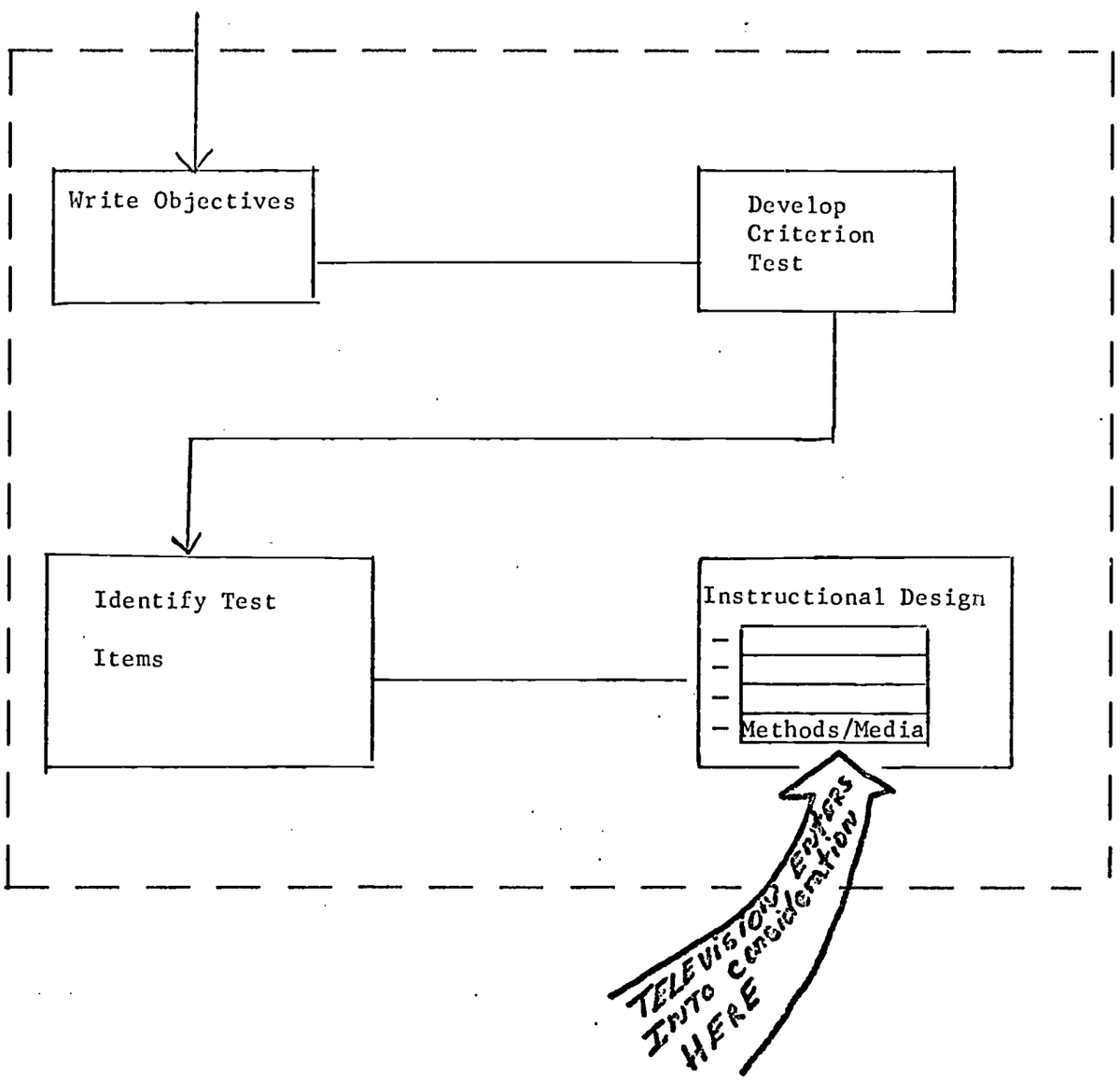
* Refers to course hours. Not to be confused with actual tapetime which would only occupy a portion of most hours designated for ITV.

Experimental results (Methods Section TV Reports No. 1, 1967 and No. 2, 1968) have shown that we can expect a 25% time savings with equal or increased learning effectiveness for every hour of conventional instruction we convert to ITV. TV, of course, will continue to play a major role as an immediate feedback device for "meet and deal" skills training. The availability of television hardware to the field will enable them to expand their efforts in this type of training as soon as the equipment is received.

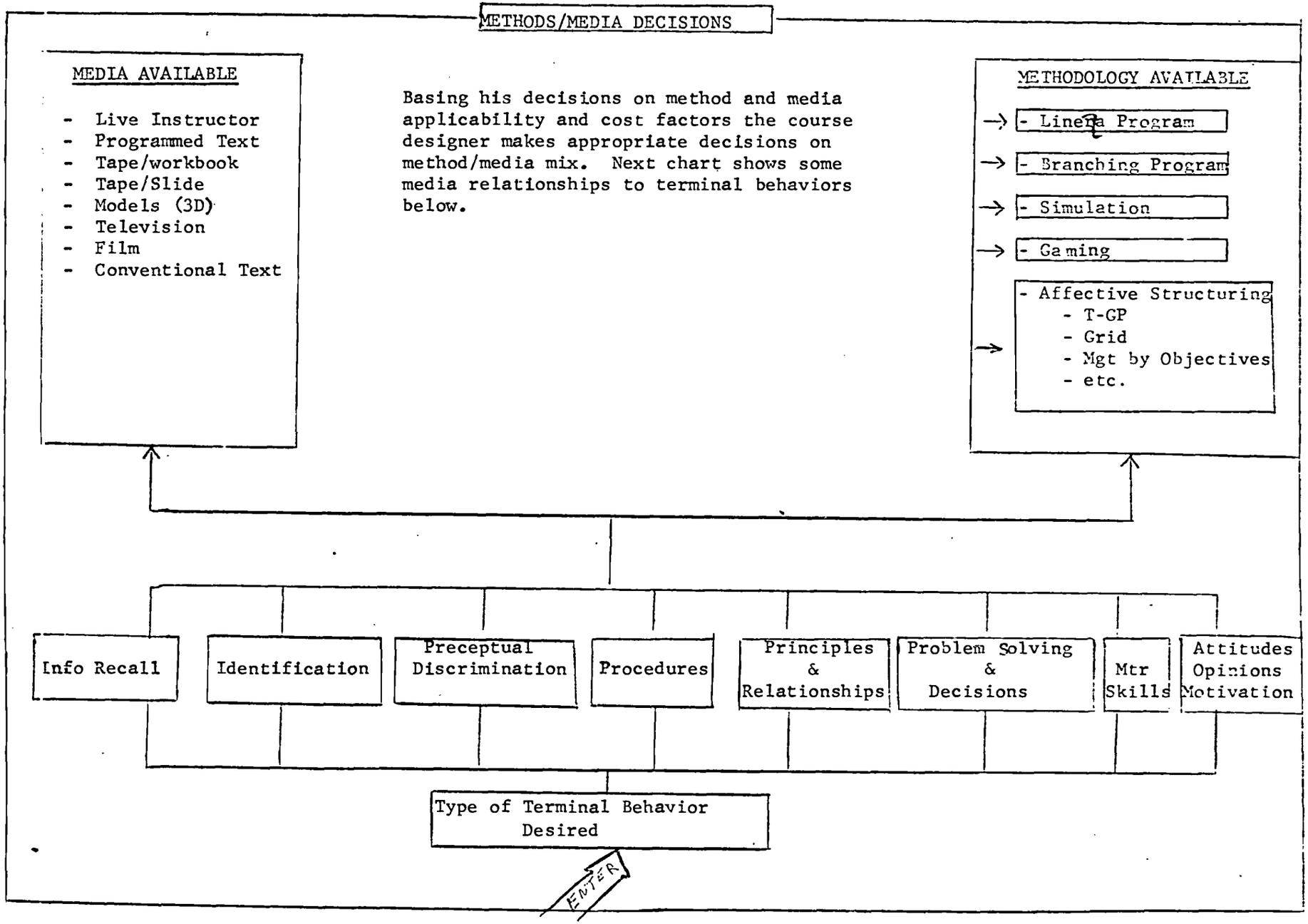
In addition to the major uses of a CCTV system described above we will be able to realize other benefits as well. One of these is in the area of management information. An example of this is the preparation of programs similiar to the videotape used to kick off the "Systems 69" ADP Training conference last year and subsequently replayed for information purposes. Field video capability will enable us to extend communication with greater impact than the written word offers. The ease of operating this equipment will also enable us to preserve for future use the presentations of many experts in technical fields whose wisdom, face-to-face, otherwise is limited by their availability to travel.

Television will become one presentation medium, among many, available to the course designer. In terms of our training system we can look at it this way;

DESIGN TRAINING SYSTEM*



* This is the second of four major subsystems within the entire training system. Task analysis is accomplished in the first subsystem, the course is produced in the third subsystem and conducted in the fourth subsystem.


METHODS/MEDIA DECISIONS
MEDIA AVAILABLE
- Live Instructor
- Programmed Text
- Tape/workbook
- Tape/Slide
- Models (3D)
- Television
- Film
- Conventional Text
Basing his decisions on method and media applicability and cost factors the course designer makes appropriate decisions on method/media mix. Next chart shows some media relationships to terminal behaviors below.
METHODOLOGY AVAILABLE
- Linear Program
- Branching Program
- Simulation
- Gaming
- Affective Structuring
- T-GP
- Grid
- Mgt by Objectives
- etc.
Info Recall
Identification
Preceptual Discrimination
Procedures
Principles & Relationships
Problem Solving & Decisions
Mtr Skills
Attitudes Opinions Motivation
Type of Terminal Behavior Desired
ENTER

Objectives / Media or Multi-Media	Recall of Specific Information	Learning Identifications	Learning Perceptual Discriminations	Learning Principles & Relationships	Making Decisions & Solving Problems	Performing Motor Skills	Developing Desirable Attitudes Opinions & Motivations
Graphics (charts, trans., slides, print)	2	5	4	3	1	1	1
Series of Graphics (slides, filmstrip, print)	2	5	4	3	1	1	1
Film for Group viewing	3	3	4	3	2	1	3
Film for Indiv. viewing	3	5	4	4	2	3	4
Videotape for Production	3	5	4	4	2	1	3
Videotape for immediate feedback	1	1	1	1	2-4	3	5
3D Models	1	5	5	3	1	4	1
Convential Text-words	3	2	2	3-4	1	1	3
Convential Text-words and pics.	3	2	2	3-4	1	1	1
Programmed Text-words	5	4	2	3-5	1	1	1
Programmed Text-words and pics.	5	5	3	3-5	1	1	1
Live Lecture	3	2	1	2	1	1	3
Audio Tape	3	2	1	1	2-3	3	3
Tape/Workbook	5	2	3	3	3	1	1
Slide/Tape	3	4	3	3-5	3	1	1
Slide/Tape with response	5	5	5	3-5	3	1	1
Film/Workbook	3	3	4	3-5	2-4	1	1
TV/Workbook	3	3	4	3-5	2-4	1	1
TV/Workbook/Live-Interaction	4	3	4	4-5	2-4	1	5

Media/Method Relationship to Training Objectives

1- not appropriate

2- no advantage in reaching this type of behavior

3- acceptable for this type of behavior

4- advantageous for increased learning effectiveness

5- very effective media for this type of behavior

PREPARING TO USE THE SYSTEM

A recent study of the use of ITV in schools and colleges indicated that maximum use of television for effective learning at a minimum dollar cost can best be accomplished by:

. Concrete planning of the terminal behavior which is to be acquired through the use of ITV.

. Involving training personnel at all levels in program production and evaluation with the cooperation of the professional TV staff.

. Conducting periodic workshops and training sessions for instructors on the best practices and procedures for effective use of television.

. Having a field staff adequately prepared to assure full and proper use of TV lessons.

. Providing a capable engineering staff to assure prompt repair and minimum down-time of all equipment.

. Combining the best principles of broadcast management and educational administration. (BM/E 1968)

This sounds rational, however many organizations do not lay this ground work and therefore do not realize the full potential of TV. Television works as an educational tool, there is not question of its validity as a medium of instruction. "Students can learn from television, as they can learn from teachers and texts, radio, recordings and films. But educators are still far from grasping the real nature of the potential of television. Television has usually been introduced into schools and classes without changing anything else, just as movies were used in the assembly programs of an earlier day. Few have used the new technology to help bring about a basic change in instruction, and there has been little relating of television to other new media..." (Murphy & Gross 1966). This clearly indicates that an education process for our own staff will be necessary before we can make full use of our proposed hardware. This process should be directed at three groups: NTC CDI staff, instructors, and field training personnel.

Training in the use of television hardware and course development for the TV media are important for NTC CDI and Methods personnel. However, much of this can be accomplished through OJT and as part of our internal staff development programs. Course Developers and Instructors whose primary responsibility will be in the area of ITV production need more in-depth training. As a first step toward meeting this type of training

need we have made informal arrangement with the Defense Information School (DINFOS) Ft. Benjamin Harrison, Indiana to accept our people in their Broadcast courses. DINFOS has the responsibility of basic communications training for all enlisted and officer personnel of the uniformed services who work in public information and broadcasting. Our people would monitor portions of their Broadcast Specialist Course and Basic Information Officer's course. During the five to six weeks they would spend at DINFOS they would become familiar with all phases of TV production. At the end of the course they would be able to prepare instructional material for television and present it in a polished manner, on camera.

For field administrators, probably training center officers, we will conduct a one week workshop with follow-up visits to selected field locations. A possible agenda for the workshop follows:

Mon. AM - Overview of IRS Servicewide TV for training
Introduction to CCTV hardware (general)

PM - Proposed course development for TV and its impact on overall IRS training Course Development for TV.

Tues. AM - "Hand-On" Session and tour of NTC production facilities

PM - Use of TV in the classroom

Wed. AM & PM / Thurs. AM - Production Workshop - instruction in basic production techniques for ITV & "meet and deal" training. Each trainee will prepare a short tape for playback and evaluation.

Thurs. PM / Fri- AM & PM - Feedback instruments in the preparation and conduct at telelessons. What we'll use. They're importance in the validation of amterials and evaluation of learning effectiveness.

A similar workshop will be held for selected full-time field instructors with a similar agenda. With the instructors the primary emphasis will be on optimal use of TV software and adjunctive materials in the classroom. To insure that all future instructors have the benefit of this training an optional television module will be added to the Servicewide instructor training course. In the future, the field should be able to train their own full-time instructors after the initial period of familiarization with the system has passed.

COST BENEFITS OF IMPLEMENTING SERVICEWIDE USE OF TELEVISION

We will examine the cost-effectiveness of television in two ways. First relating it to the types of terminal behavior described in the illustration on page 5 and second showing the potential dollar savings of using TV in an actual course.

1. Television and various terminal behaviors:

a. Learning Identifications, i.e. includable items of Gross Income: Television is highly effective as a media for producing this type of behavior and less costly to use than all others performing as well, with the exception of photos, slides or charts when they are applicable.

b. Learning Preceptual Discriminations, i.e. distinguishing various types of returns while sorting at Service Center: Same as a. with the addition of audio-recordings as another less expensive alternative when they suffice.

c. Following Procedures, i.e. Service Center coding and editing: Same as a., however, simulation not requiring expensive hardware and not requiring TV may be less costly if feasible within the required enviroment.

d. Learning Principles and Relationships: Same as c.

e. Learning Motor Skills, i.e. typing or key punching: Generally not as effective as simulation using actual equipment or models but far less costly in many instances.

f. Attitude change, i.e. interpersonal skills training: The most effective media when used as an immediate playback device.

2. Based on the segment of the Basic Revenue Agent Course mentioned earlier in which 55 hours were identified as having a high potential for ITV the following cost comparison was made using FY67 data and assuming all 55 hours were developed for and presented on ITV:

COST OF CONDUCTING COURSE

Number of Trainees -	1421
Course Length (hours)-	520
Total Travel & Per Diem -	$ 834,831.00
Trainee Salary Per Hour (figured at GS7 step 1)	$3.36
Total Trainee Salary Cost - (520)(1421)($3.36)=	$2,482,771.20
Total Instructors (figured at 57 classes with 3 per class)-	171
Instructor Salary Per Hour (figured at average of step 1 GS11/GS12 step 1)-	$5.38
Total Instructor Salary Cost ($5.38)(171)(520)	= $ 478,389.60
Total Course Cost (not including overhead, operating expenses and opportunity cost)=	$3,795,991.80
Per Hour Cost of Course $\left(\frac{\$3,795,991.80}{520}\right)$ =	$ 7299.98
Per Hour Cost per trainee $\left(\frac{\$7299.98}{1421}\right)$ =	$ 5.14
Course Cost Per trainee ($5.14) (520) =	$ 2672.80
Hours studied identified as appropriate for ITV=	55.25
Savings in hours (25% of 55.25) =	13.55
Savings in dollars (13.55)($7299.98) =	$98,914.73

DEVELOPMENTAL COST OF COURSE EXAMINED

Conventional Instruction: Based on experience showing 20 manhours for development of every hour of instruction. These are GS 12/13 - CD-I manhours.

(520 hrs)(20 mhph)($6.39 ph) = $66,456 developmental cost
or
$8818.20 developmental cost for the 69 hours

Programmed ITV: (For one hour of programming)

Manhour breakdown

GS 12/13	30 hrs. (CD-I)	= (30)($6.39) =	$191.70
GS 12/13	15 hrs. (Methods)	= (15)($6.39) =	95.85
GS 11	5 hrs. (Art)	= (5) ($4.91) =	24.55
GS 13	8 hrs. (Instr.)	= (8) ($6.93) =	55.44
GS 12/13	8 hrs. (Prood/Dir.)	= (8) ($6.39) =	51.12
GS 7	8 hrs. (Tech.)	= (8) ($3.36) =	24.88
GS 4	16 hrs. (Cameramen)	= (16) ($2.47) =	39.52
			$483.06 ph

This developmental cost is high but it is more than balanced by the potential savings. Using the above example and assuming that all 55.25 hours identified were presented via TV we would show a direct dollar savings of $72,225.66. This is only an example but it does clearly indicate that the capital expenditure of approximately $100,000 for the television hardware, for the field and the production center would be readily absorbed in the first year of use. Further, we can see that TV would continue to pay for itself in terms of reduced classroom time and increased effectiveness.

GENERAL CONSIDERATIONS USED TO DETERMINE SCOPE OF HARDWARE EVALUATION

Hardware was evaluated based on the criteria that individual components of the system must be flexible enough to support a varied and as yet only partially defined input and capable of producing the highest quality output within acceptable cost benefit limits. This

means that the basic field equipment package must be capable of recording and playing back locally produced role plays, interviews and other types of "meet and deal" skills training. It must also be capable of playing back centrally produced instructional programs. The NTC central production facility must be an integrated studio complex containing all hardware necessary for the production of top-quality videotapes for duplication and release to the field.

There are three possible methods by which we could originate a video signal for viewing in various field locations:

1. A microwave link
2. Cable transmission
3. Production of duplicate tapes for each user

Since the first two alternatives are prohibitively expensive (Possibly as much as $1,000,000 for basic electronics) efforts were concentrated on the third. In a system that depends on duplicating a master tape several times the videorecorder becomes the most important hardware component in the system. The quality of the classroom image depends primarily on the master recorder's ability to capture the original image and the playback machine's ability to replicate the original image.

VIDEO TAPE RECORDERS (VTR'S) EVALUATED

Videorecorders can be divided into two broad categories based on the type of recording head used. These are:

1. Quadrature recorders (Quad) - These are the standard recorders used in commercial television and until 1964-65 the only videorecorders manufactured. All models utilize standard recording techniques and a tape recorded on any Quad machine can be played on any other. With a few exceptions, they are the only machines capable of producing a video signal of sufficient stability to meet broadcast requirements. However, Quad recorders are expensive (minimum $25,000 per unit); non-portable; and require a professional technician for operation and first-line maintenance -- as a result they were not considered appropriate for field use. However, they remain as a possibility for the production center.

2. Helical scan recorders (also called "slant track") - All other recorders currently available fall into this category. There is wide variation in image quality from model to model and manufacturer to manufacturer. Since many manufacturers have patented their own recording processes there is no compatibility between the machines of one manufacturer and the machines of another, nor will there be in the foreseeable future according to most industry sources. This means that extreme care must be taken to select for our system the recorder or recorders that offer us the greatest flexibility, without losing the ability to record a tape on one machine and play it on another.

EVALUATION OF HELICAL SCAN VTR'S

During the past year we have attempted to evaluate all helical-scan VTR's intended for the educational/industrial market. The products of manufacturers such as Fairchild Instrument Company and Westal Engineering were not considered since these are specialized, costly machines intended for instrumentation purposes. For example, Westal's VTR's are used primarily in missle guidance systems. Since this is a young, vigorous industry some VTR's may have been overlooked but we have evaluated a sampling of machines from all major manufacturers.

Helical scan VTR's can be divided into three categories based on tape size; ½ inch, one-inch and 2 inch. With one exception, which is explained in appendix 2, extensive evaluation of ½" VTR's has not been made since all experience indicates that the resolution capability (the apparent sharpness of the screen image) of the ½" format which is less than 200 lines is not sufficient for transmission of the types of TV instructional programming we envision. Image quality is discussed mainly in terms of resolution. Approximately 250 lines of horizontal resolution is the minimum we need for the type of programs we will be producing. Little consideration was given to 2" machines for three reasons:

1. High cost
2. Limited availability. Two-inch format being phased-out by the industry.
3. Most one-inch machines are capable of comparable performance.

Before discussing any conclusions we have reached it is necessary to list the basic qualities we have been looking for in a VTR. The following can be considered necessary characteristics any VTR we purchase must have:

1. Complete tape interchangeability with other VTR's owned by IRS.
2. Capable of producing a readable image when playing back standard graphic material (must have about 250 lines resolution on playback to do this).
3. Capable of accepting, through a mixer, multiple audio inputs.
4. Capable of accepting, through a switcher, multiple video inputs.
5. Compatible with standard head-end (cameras, microphones, etc.) equipment.
6. Operable by the average training office or instructor (does not apply to NTC recorder).
7. Maintenance service must be available within reasonable distance from all potential installations.

Further considerations for NTC master recorder:

1. Must be capable of professional quality electronic editing for production purposes.
2. Must be capable of producing high quality, broadcast quality type signal for purposes of production taping and transfer to film.
3. Need not be compatible with other IRS VTR's if it is a Quad machine capable of dubbing down to 1" for duplication.

Other considerations:

Are we paying for unnecessary features (electronic edit, stop motion, audio dub, etc.) on field machines?

Appendix 2 contains a compilation of the results of our evaluation. It is evident from page 35 of Appendix 2 that Ampex VR5100 offers us the qualities we need in a VTR (with no frills) at the lowest price of all one-inch VTR's on the market. At the other end of the spectrum, the Ampex VR7800 is the only one-inch machine which gives us the capability we need at NTC. With the exception of Ampex all other manufactures of one-inch VTR's offer one basic model. Since we can assume a growth in the use of TV after the system is installed, Ampex with its complete line of compatible recorders assures us of the ability to add-on in the future without obsoleting our initial purchases. "Buy American" may also be a factor since all machines with the exception of Ampex and IVC are of foreign origin. Further all Ampex one-inch machines have complete interchangeably with each other and the various models available offer us system flexibility. Experience of other government, industrial and educational users of helical scan VTR's to date showed Ampex to clearly be the leader with approximately 90% of all users owning Ampex equipment (See Appendix 3).

STANDARD CONFIGURATIONS OF FIELD EQUIPMENT

The basic configuration of field hardware must include the following:

1. Videorecorder
2. Camera (including lens & tripod)
3. Monitor
4. Microphone
5. Speaker - (either in recorder r monitor)

This is the absolute minimum necessary to record and playback an audio and video signal. Realistically, this minimum is not sufficient to meet field needs since one monitor would not be sufficient for a class of 25 trainees and more than one microphone should be used for role plays.

Each of the following can be viewed as a basic system for the field. Alternatives 1 through 3 add more flexible components to the basic system for further adaptability. All four configurations are portable but could become part of a permanent studio.

Basic System:	Approximate Cost
Recorder: Ampex VR5100	1600
Camera: Ampex Camera Package (incl. remote control, lens, tripod)	600
Monitor: 3 20" monitors @ 285 ea.	855
Microphone: 3 Lavelier microphones @ 15 ea.	45
Mixer: Audio Mixer with 3 input channels	50
	3150

Alternate I (add to basic system)

1 zoom lens	550
1 9" camera monitor	195
	3895

Alternate II (basic 2 camera System w/zoom)

1 additional camera package w/zoom lens and monitor	1345
* 1 video control center to drive 2 camera	400
	5640

Alternate III (more sophisticated version of II above)

Substitute - 1 studio camera	2000
1 rear controlled zoom lens	700
1 pedestal & cradle for camera	1000
	7945

* Video control center desirable but not necessary on any Ampex VTR since simple camera switching may be accomplished using the remote switch on the recorder.

Explanation of alternates:

I.- Probably what we should consider basic for field use since the addition of a camera monitor and zoom lens provide flexibility which is necessary for varied uses.

II.- Minimum we can consider for any installation we want to have even a minimum, rudimentary production capability. Especially important for service centers where there will be a requirement to use equipment on the floor.

III.- Should not be of immediate interest for any installation but should be considered as the next step for RTC's that have demonstrated their competence with more basic equipment. This will give them the ability to serve as production satellites on simple assignments.

Standards for field equipment:

Videorecorder: Since each manufacturer of VTR's utilizes a different record/playback format it is essential that all field equipment be compatible and therefore from the same manufacturer. Compatibility has been determined on the basis of independent tests and IRS evaluation. With the exception of Ampex, all manufacturers of one-inch helical scan recorders offer only one or two models. Since we are interested in maximum flexibility at minimum cost Ampex recorders must be the standard as they offer us a complete line of recorders with proven interchangeability throughout the line. For initial installations the Ampex VR5100, the lowest priced record/playback unit, will be considered the standard. Future requirements may necessitate consideration of other models in the series.

Camera: Assuming we adopt the standard of Ampex VTR's then the standard for a nonviewfinder camera would also be Ampex. The Ampex "camera package" is specially designed for Ampex recorders and enables one man to operate both the camera and recorder (via remote control from the camera). Other manufacturers offer comparable cameras, less the remote control feature, in the same price range. Studio cameras of the type considered in alternate III are available from several manufacturers and will not at this time be considered a standard item. Rather, as the need arises, cameras will be evaluated on standard industry-wide performance criteria.

Zoom lens: Any standard 16mm zoom optic meeting the following criteria is sufficient:

- coated optics
- 5:1 zoom ratio
- maximum aperature no less than f2.8

Monitor: Any 20"-23" monitor meeting general industry standards for CCTV use.

NTC PRODUCTION CENTER COMPLEX

In order to fully discuss the type and configuration of equipment necessary for the master production center we must also deal with the larger question of the physical facility itself. The facility is a separate issue and is being dealt with in detail in another study. For purposes of this paper it is enough to say that our ability to reach the high production standards we envision as necessary is tied to some facilities considerations. The most important of these are:

1. Studio space large enough to accomodate reasonable camera to subject length and a variety of shot angles. A square space about 40' X 40' or larger would be ideal. Also a high structural ceiling with a lighting grid no lower than 12 ft. would be desirable. An uncarpeted, electrically grounded floor is a must.

2. Accoustics are of paramount importance. To produce tapes of high quality we must be able to exclude all outside sounds from the studio complex and should have a low ambient noise level within the studio.

Hardware Considerations:

Hardware choices for the master production center are critical since they can affect both the quality and kind of television instruction available in the field. (Murphy & Gross 1966). In the three years that the present NTC System has been in operation we have learned a great deal about some of the common pitfalls that plague the installation of ITV systems. Perhaps the most important pitfall is the hazard of using improper methods of attaining a stable high quality image on the screen. The moving image we see on a TV screen is composed of individual still frames similar to motion pictures. If you look at movie film you can see these still frames and 24 of them pass across the screen each second giving "motion". In television the frames are electronically "written" on the picture tube at the rate of 30 per second. Each television frame is made up of two fields. Each individual field contains ½ of the picture material you see in the frame. In other words, the TV camera must electronically scan each scene twice to record a complete frame. In order to produce a stable, high quality, reproducable image this scanning must be accomplished in a systematic, continuous, sequential fashion. This process is called synchronization or "sync".

There are two ways to do it. One is 'broadcast' or EIA (Electronic Industries Association, a trade group that won FCC approval for the American television 'standards' in 1941 and is used by all broadcasters today) sync, and the second type is known as 'industrial sync'. Both methods produce excellent picture quality (providing other systems components are equal)... The serious disadvantage of the 'industrial' TV system is its incompatibility with the broadcast standards of transmission required by the FCC (Lapham 1967). This incompatibility causes a further problem in that an 'industrial' signal is generally not wholly compatible with other components necessary for production. Further since 'industrial' components need not meet any rigid industry wide standards (as EIA components must) quality is generally lower and in most instances picture quality suffers greatly.

In order to produce a master tape of sufficient quality that it can be duplicated several times we must insure that we have firm electronic controls on the production process, this means we need a "broadcast type" system. It does not mean we will be installing a system capable of sending a signal over an open circuit. What it does mean is that individual components of the system (with the possible exception of recording equipment) will meet broadcast specifications. By purchasing components meeting broadcast specifications we will insure that we are getting standard items and will build a central electronics system that is capable of handling any type of camera input and can deliver acceptable output to any chosen source thereby insuring flexibility to meet future hardware acquisition.

Specific Equipment Recommendations:

The present NTC hardware is inadequate to meet the needs of any part of the proposed system. It is in a poor state of repair and only emergency repairs have been made for the past year since major repairs on many items would have nearly equalled replacement cost. This equipment will be declared surplus, used for emergencies or traded on new equipment.

Most of the components necessary to complete the system are standard items and need no discussion. However, there is a rationale in making definite decisions on two items:

1. Studio cameras (2). These should be of the "camera chain" type with separate camera head and camera control unit to enable operation from the studio and fine control from the control room. They should utilize a plumbicon tube since it incorporates the best features of both vidicon and image orthicon tubes - ability to operate in relatively low light

levels and low signal to noise ratio. They must accept rear control zoom optics, filter wheels and apperture correction. Recommend Ratheon 520 or Norelco PK.

2. Recorder: Ideally the master VTR should be of the quadrature type for absolute guarantee of highest quality signal and ability to duplicate all commercially available material. Master tapes can then be dubbed onto 1" Ampex format. However for reasons of cost and staffing this is not considered feasible at this time. An acceptable substitute is the Ampex VR7800-03 which is a highly sophisticated helical-scan machine. The VR7800-03, properly used, can meet FCC broadcast standards and is capable of equalling a quad machine in performance.

RECOMMENDED HARDWARE LIST

Item	Purpose	Cost
Studio Cameras (2) Raytheon 520	Replace present industrial viewfinder cameras. Must have viewfinders and be capable of producing 750+ lines of resolution. Must be capable of necessary fine tuning. Will be used for master production. Plumbicon.	$20,000
Camera Control Unit	Control package to drive above cameras.	$ 600
Zoom lens (2)	Rear Controlled lenses for above cameras.	$ 1400
Pedestal and Cradle (2)	Mounting for above cameras for maximum maneuverability.	$ 2000
Pulse Distribution Amplifier	Assures standardized, stable video signal from all cameras into system. Necessary for quality tape production.	$ 1000
Sync Generator		$ 1500
Waveform Monitor (2)	Electronically monitors video signal of each camera assuring compatible output.	$ 2200
Video Distribution Amplifier (3)	Control Device for video signal level from all video inputs.	$ 1200

Item	Purpose	Cost
Switcher/Fader	Smooth switching from one camera to another.	$ 1700
Distribution Switcher	Send video signal to remote locations (classrooms)	
Special Effects Generator	Allow fades, dissolves, supers, split screen, etc.	$ 1300
Preview and Pgm Monitors (6)	9" and 5" monitors to replace current monitors & accommodate wave from monitors. (Cost is less trade-in)	$ 2500
Film Chain	Allow taping of slides. Will utilize one of present Diamond Cameras.	$ 1500
VTR's (2)	One master and one reproduction machine 1" format. (Cost is less trade-in)	$20,000
Lighting System	Provide adequate light levels for quality taping.	$ 1000
	TOTAL:	$57,000

STAFFING CONSIDERATIONS

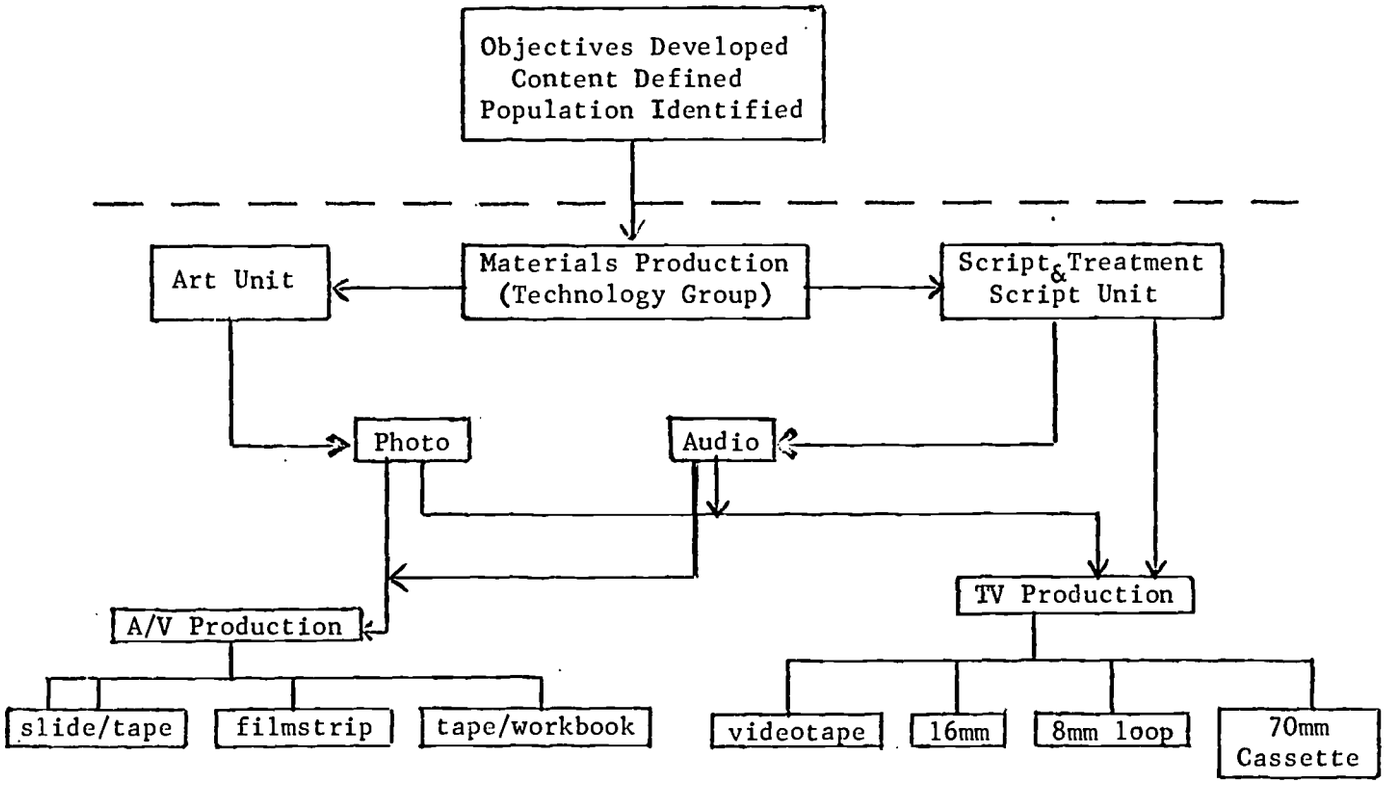
Since the initial field equipment is relatively uncomplicated and intended primarily for use in "meet and deal" skills training and playback of centrally produced tapes no additional staffing will be required for implementation of the system.

In an earlier report (Occasional Paper No. 6, 1968) we indicated the types of skills necessary to produce an ITV lesson. We indicated that one person may perform more than one function as long as we are not producing programs at a steady rate. To properly implement ongoing production we must examine skills in detail and consider additional staffing necessary to meet the new workload. If we intend television to pay for itself as a presentation device in ongoing classes then we must begin the large task of producing telelessons very soon.

For the TV instructor to be completely effective he must have special skills in his subject matter and in communications. He must be allowed to focus his full attention on the production of television programming (BM/E 1968). To reach this goal we must think in terms of recruiting one or more men from the field who are subject matter experts and have passed an audition signifying their qualifications to become competent television instructors. The experience of many educational institutions that have well developed ITV systems has shown that a television instructor, working full-time, can be expected to produce one program-hour per week. This means that with a minimum of one television instructor it will take us one year to produce just the 55 program hours of the Basic Revenue Agent Course.

In the area of production staff we have definite needs. We must have a full-time producer/director to support the continuing production effort. Initially he could also spend some time on Methods work but within one year he would have to concentrate all his efforts on TV production.

Television production does not stand alone. It is part of an entire multi-media effort and as such has strong ties to production for other media which have not been dealt with in this report. For example, the average telelesson will probably utilize auxilary audio input and still-art as well as the TV instructor in the presentation. This means that hardware other than straight TV hardware should be considered in any television production. A chart for multi-media production might look like this.



Since we are in the process of negotiating a contract for a complete study of our production needs for the next 5 to 8 years we realize that many of the conclusions drawn in this paper may be modified to reflect the results of that study. Also, since television is intimately related to audio production; using some of the audio hardware and the same studio space; decisions on audio production and duplication will have some effect on television production.

IMPLEMENTATION SCHEDULE

Based on this paper we recommend the following implementation:

March - Begin preparation of specifications and invitations to bid

April - Invite bids
- Plan workshops of CTO's and instructors

May - Begin evaluation of bids

June - Complete evaluation of bids
- Award contract for field equipment (late June or July 1)

July - Accept delivery of field equipment at NTC. Test equipment and ship to field
- Award contract for NTC production center

August- Train Television Instructors

Sept. - Run Instructor Workshop
- Begin lesson development

APPENDIX 1

PARTIAL ANALYSIS OF ROLE OF TV IN IRS TRAINING

Advanced Income Tax Law - Tax Technicians - 18 days

Portions Feasible for TV Production

Outline	Subject	Time Allocation	
1	Single & Double Entry records, etc.	5	
3-1	Taxable Years & Tax Benefit Doctrine	2	
3-2	Gen. Role of Acct. Methods	2	
3-3	Accural Method	2	
5-1	Basis & Adjustment to Basis	4	
5-4	Gen'l Meaning of Property	6	
Chapter 7	Farmers	8	Optional Unit for areas w/large farm population
9-1 9-2	Corps, Filing, Reg. Rates, Etc.	4	
10-1, 10-2 10-3	Partnerships	6	
Chapter 2	Application of Funds, Networth Method	8	Taught after Chapter 10
11	FICA, Withholding, etc.	2	
		49	
		Total hrs. 144	

Revenue Officer Phase I

Portions Feasible for TV Programming

Unit	Title	Pages Text	Pages Wkbk	In. Gde	Time Allocation	Comments
II	Organization of IRS	7-29	1-3	2.1-2.65	3	do whole unit
III	Collection Activity (Organization of DAR Br)	29-36	——	3.1-3.7	2	do whole unit
IV	R.O. Occupation	37-45	4-9	4.1-4.15	8	cut to 4-6 w/2 on tape
V	Origin of TDA/TDI	Separate Book			12	Partially on EDEX/1/3 for TV
VI	Income Tax Accounts & Adjustments			6.16-6.18	16	Partial paper pgm can cut to 8 w/TV
IX	Excise & Special Taxes	Use TV for Portion Highway Tax (				2-4 hrs)
X	Investigative Principles	53-59	32-58	10.1 10.9	8	Video tape 2 hrs.
XI	Interview Techniques		48-56	11.1 11.20	8	Video tape 2 hrs.
XV	Lein/Levy/Seizure	Use TV for Introduction to Seizure				(8hrs. on seizure)

INTERNAL REVENUE AGENT TRAINING PROGRAM - PART I
PART I, INDIVIDUAL PARTNERSHIP AND SIMPLE CORPORATION, BOOK I
UNITS THAT CAN UTILIZE VIDEO-TAPED LECTURES
AS A PRESENTATION OF KNOWLEDGE VEHICLE

Title of Course Outline	Outline Number	Text Coverage	Time Allocation Study	Time Allocation Class	Level of Application*
Introduction - General	1-1	1.0-6.6	2	2	1
Introduction - significance of the form of benefit	2-1	7.1-9.0	3/4	1/2	2
Significance of the source of benefit	2-2	10.0	3/4	1/2	2
Introduction - Benefits incident to employment	3-1	11.0-12.25	1 1/4	1	2
Benefits Incident to Employment - Fringe Benefits	3-2	12.31-12.33	1 3/4	1 1/4	2
Benefits Incident to Employment - Fringe Benefits (cont.)	3-3	12.34-12.36	2 1/4	1 3/4	2
Benefits Sometimes Gratuitous in Character	3-4	13.0	1 3/4	3/4	2
Death Benefits-From Life Insurance & Employees' Arrangements	3-5	14.0	1 1/4	1/2	2

*See Criteria Sheet

Title of Course Outline	Outline Number	Text Coverage	Time Allocation Study	Time Allocation Class	Level of Application
Benefits from Injury to Person or Property	3-6	15.0	2 1/4	1 3/4	2
Benefits from Discharge of Indebtedness	3-7	16.0	1	1	2
Benefits from Investments -- interest, rents and royalties	3-8	17.0	2 1/4	1 1/4	2
Benefits from Investments - Annuities and related benefits	3-9	18.1-18.44	1	1	
Benefits from Investments - Annuities and related benefits (cont.)	3-10	18.5-18.99	1 1/4	1	
Benefits from a trade or business - inventories	3-11	19.1-19.523	1 1/4	1	3
Benefits from a trade or business - inventories (cont.)	3-12	19.53-19.6	1 1/4	1	3
Returns of Individuals	4-1	24.1-24.26	3/4	3/4	
In General [1] -- Penalties					
Income Splitting Mechanisms [2]	4-3	25.1-25.6	1 1/4	1	2

[1] Presently on EDEX
[2] Presently on EDEX

Title of Course Outline	Outline Number	Text Coverage	Time Allocation Study	Time Allocation Class	Level of Application
Trade or Business Expenses	5-1	28.1-29.23	3/4	1/2	2
Expenses vs. Capital Expenditures and Certain Deductions Peculiar to Farming	5-2	29.3-29.3459	2	1 1/4	2
The Limitations of Ordinary & Necessary	5-3	29.41-29.4444	1	1	2
The Concept of Carrying on a Trade or Business	5-4	29.5-29.9	1 1/4	1	2
Deductions Under Sect. 162(a)(1) of Reasonable Compensation for Services Rendered	5-5	30.0-30.5	1	3/4	1
Rental Expenses as a Deductible Category	5-6	31.1-31.5	1 1/4	3/4	3
Entertainment Expenses	5-9	33.1-33.3424	2	1 1/4	3
Entertainment Facilities and Club Dues	5-10	33.41-33.510	1 1/2	1 1/4	3
Gifts	5-11	33.6-33.65	3/4	3/4	3
Elements of an Expenditure	5-12	33.71-33.743	1	1 1/4	3
Substantiation Rule of Sect. 274	5-13	33.75-33.102	1 1/2	1 1/4	3
Education Expenses	5-14	34.1-34.3	3/4	3/4	3
Work Clothes, Evening Meals Occasioned by Overtime Work, etc.	5-15	35.1-36.2	1 1/4	1	3

NOTE: Those outlines noted for a Level 3 presentation should be held until we have experience with Level 1 and 2 programs.

CRITERIA FOR USE OF TV IN R.A. BASIC COURSE

A. Description of Kinds of Applications

Level 1 Use

Information transmission - no overt student participation. Not much planned covert student response. General objectives. Overview, stage setting, nice to know info., for example, unit introduction, historical data, summary, functional orientation.

Level 2

Info. Transmission - premium on conciseness and clarity. Same student responses as above. Pre-printed notes. Planned follow-up discussion question. Hard to communicate concepts. Unusual subjects. Foundations to be used later.

Total package (TV & discussion & testing) obj. specific. TV objectives, fairly general.

Level 3

Info. Transmit and test - planned overt and covert responses -- questions, problems, short discussion periods, workbook activity. Closest to fully programmed. Need to know data. TV includes full circle. Present, test, clarify, apply. All in circle. Objectives specific.

APPENDIX 2

EVALUATION OF HELICAL SCAN VIDEORECORDERS

Manufacturer	Also Marketed By	MACHINES AVAILABLE Model	Price	Comments
one-half inch				
Matsushita (Japan)	Panasonic, Concord	NV8000 NV8100 NV8200	800.00 950.00 1500.00	-basic model w/still frame & electronic edit -8100 w/color adaptability & remote control option. No real resolution difference according to specs. Basically the same machine as NV8100.
SONY (Japan)	GE, RCA	DVK2400 CV2100 CV2110 CV2200	1250 795 1050 850	-battery operated portable system. Record only. -audio dubbing possible -basic model w/built-in monitor -basic model adaptable as duplication unit
Shibaden (Japan)	APECO	SV700U SV800U	995 1295	-specs claim over 300 lines resolution (more than any other ½") -basic model w/built-in monitor
3M (U.S.)	———	VTR150	995	-also available as part of mobile console
One inch				
Panasonic (Japan)	Matsushita, Concord	NV204 NV205	3600 5000	-color adaptable -color adaptable, 2 audio channels, elec. edit.
SONY (Japan)	GE, Westinghourse	EV210	3750	-also available w/elec. edit; remote control; color adaptable. GE & Westinghouse market older models no longer offered by Sony.
Shibaden (Japan)	———	SV727	Not Available	-color record & playback
Norelco (Netherlands)	———	3403	2400	-color adaptable
IVC (U.S.)	GPL, RCA Bell & Howell	800	4200	-color record; color playback adaptable

Manufacturer	Also Marketed By	Model	Price	Comments
Ampex (U.S.)	Raytheon	VR4900	995	-playback only
		VR5100	1600	-economy unit, 250-330 lines resolution
		VR5900	2900	-playback only; rack mounted CAI unit
		VR7000	2500	-350 lines resolution; color adaptable; 2 video outputs; stop motion.
		VR7500	4500	-2 audio channels; color adaptable; hi/low band record & playback
		VR7800	9500ap	-modular construction; w/EIA Sync/processor meets FCC broadcast standard; professional elec. editing.
Two-inch				
SONY (Japan)	———	PV120U	8900-12,500	-color compatible; adaptable to meet FCC broadcasts standard
Ampex (U.S.)	———	VR660	8900 up	-available only on special order
Miscellaneous				
Craig (Japan)	- new entry in ½" & 1" markets (probably manufactured by Sony or Panasonic)			
Roberts	- prototype ¼" VTR utilizing standard audio tape built on same chassis as 4 track stereo audio recorder. Will sell in $1000 range. Great potential for District level local use.			

MACHINES EVALUATED

MANUFACTURER AND MODEL	CIRCUMSTANCES OF EXAMINATION	COMMENTS
3M VTR 150 (½")	Demonstrated at NTC by manufacturer	Resolution was about 150-200 lines. Independent tests show effective rsolution of not over 150 lines*. Tests also show a great deal of picture distortion when tape interchange between machines is attempted. Useful compatability not probable.
Sony ½" models	Viewed at various shows. Demonstrated at distributor's showroom.	Same as 3M on resolution. Independent tests show excellent interchangeability characteristics.
Shibaden SV 700U (½")	Demonstrated by manufacturer at DAVI show	Picture quality was generally superior to other ½" machines but highly controlled circumstances necessary to obtain 300 line resolution.
Panasonic NV204 (1")	Demonstrated by distributor at his showroom	Performance was excellent, resolution exceeded 350 lines. Interchangeability acceptable. Only 1 audio channel.
Norelco 3403 (1")	Demonstrated by manufacturer at his showroom	Performance was excellent. Controls easy to operate. Resolution seemed to be between 300-350 lines.
IVC 800 (1")	Demonstrated by distributor in his showroom	Performance and operation, excellent. Independent tests** indicate this is an excellent machine.
Sony PV120U (2")	Demonstrated by NIH TV technician at their studio	Close to 400 lines resolution. Complete interchangeability possible with careful adjustment.

*Refers to series of tests run by California State Department of Education (1967-1968). All independent test results are from this report with the exception below.

**Broadcast Management Engineering (March 1968).

MANUFACTURER AND MODEL	CIRCUMSTANCES OF EXAMINATION	COMMENTS
Craig 640 (½")	Demonstrated at DAVI show	Independent tests show good interchangeability and 200 lines of resolution.
Panasonic N8000 (½")	Tested at FDA studio (CP No. 5). Similar Concord model used for role play at NTC on various occasions.	Recorded and played back display of graphic material including words in large type. Written information was illegible on playback.
Sony EV 210 (1")	Tested at NTC for 2 weeks	Recorded and played back test pattern using our cameras. Playback resolution about 300 lines.
Sony EV 200 (1") (Discontinued model)	Tested at NTC as marketed by Westinghouse.	Inconvenient threading. Performance not up to EV 210. Maximum resolution was 250 lines. Average 200 lines.
Ampex 1" line	VR5100 and VR7500 tested at NTC for 2 weeks. VR7800 examined in operation at a NY production studio. VR7000 not tested.	Both models tested performed at or above manufacturer's specifications. VR7500 produced better than 500 lines resolution on playback. All models are adaptable for use with EDEX. VR7800 is high quality professional machine; now being used by professional studios as master machine. Tapes viewed originally produced on 7800 of broadcast quality.
Ampex 660 (2")	Now in use at NTC	Performance during 1½ years of use has been less than satisfactory.

COMPARISON OF ONE INCH MACHINES

Make & Model	Interchangeability	Potential Image Quality	Multiple Audio Video Input	Skill Needed To Operate	Maintenance	Elec. Edit.	Bdcast Quality	Price	Extras
Ampex 5100	with all Ampex 1"	acceptable to excellent	yes	ok	ok	No	No	$1600	No
Ampex 7000	with all Ampex 1"	excellent	yes	ok	ok	No	No	2500	No
Ampex 7500	with all Ampex 1"	excellent	yes	ok	ok	No	No	4500	Yes
IVC 800	with other IVC 800	excellent	yes	ok?	?	No	No	4200	Yes
Panasonic NV 204	with other Panasonic NV204-205	good to excellent	yes	ok?	?	No	No	3600	No
Shibaden SV727	with other SV727	?	?	?	?	No	No	?	Yes
Sony EV210	with other EV210-EV200	excellent	yes	ok	ok	No	No	3750	Yes
Norelco 3403	with other 3403	good to excellent	yes	ok	?	No	No	2400	Yes
Ampex 7800	with all Ampex 1"	broadcast quality	yes	higher	ok	Yes	Yes	12,500	No

APPENDIX NO. 3

VTR'S IN USE BY EDUCATIONAL INSTITUTION

(BREAKDOWN BY MANUFACTURER)

APPENDIX 3

A survey of educational and government users of CCTV equipment revealed the following breakdown by manufacturer of VTR as of December 1967:

Dage, Dage-Bell, Raytheon	- 12
Matsuhita, Concord, Panasonic	- 14
3M	- 3
Norelco, Phillips, PYE	- 10
Precision Instruments, Mactronics	- 15
RCA	- 44
Shibaden	- 2
Sonv	- 70
Ampex	- over 700

Extracted from A Survey of Instructional Closed-Circuit Television, Department of Audio Vidual Instruction, National Education Association, 1967.

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