AUTOMATED INSTRUCTIONAL MEDIA ANALYSIS: LESSONS LEARNED AND RECOMMENDATIONS

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ABSTRACT

The Automated Instructional Media Selection (AIMS) model was used to allocate selected media to specific training objectives for the Air Force Primary Aircrew Training System (AFPATS) Ground Based Training System (GBTS). This paper discusses why the AIMS model was chosen over other media selection models, how it was used, what modifications were made, and what modifications are recommended for further use.

Choosing the best media selection model, from the more than 30 available, requires a careful matching between model capabilities and unique program requirements. Once selected, some modifications to meet specific program requirements may be necessary. For the AFPATS GBTS, the AIMS model offered the flexibility to add or delete as many as 30 candidate media and 192 instructional characteristics. The media weighting factors and the use of program-specific instructional characteristics used in the AFPATS program are discussed in this paper.

The AIMS model maximizes the use of pertinent information by automating the non-judgmental, data manipulation tasks of the media selection process. User-definable media pools and editing functions provide flexibility in adapting the model to specific problems and changing technologies. In addition, the user-definable aspect allows for inclusion of any instructional characteristic. The flexibility in defining the data manipulation can account for wide variations in the depth of front-end analysis to be accomplished.

Use of the AIMS model for the AFPATS GBTS allowed for assessing various instructional media for psycho-motor and cognitive skills. This was accomplished through program modifications that separated performance objectives from knowledge-based objectives. The flexibility in programming the reports' function was very useful in analyzing candidate media from different perspectives.

The paper presentation associated with this abstract is presented with a demonstration of the automated software used to employ the AIMS media matrix algorithms. The automated software and AIMS modeling are available through the government.

ABOUT THE AUTHOR

Larry Clemons is Manager of JWK International Corporation's branch office in San Antonio, Texas. He has twenty plus years experience in analysis, development and management of Instructional System Development (ISD) as used in government, business, industry and private sector. While on active duty in the Air Force he was a Command Pilot and Senior Space Operations Officer. Mr. Clemons developed curriculum and instructed in Undergraduate and Pilot Instructor Training. He has operational experience in pilot training for both fixed and rotary wing aircraft. In addition, he was the Pentagon Action Agent for ISD as used in the Air Force, Air National Guard, and Air Force Reserves. Mr. Clemons co-developed the current revision plan for Air Force ISD regulations and manuals. He was the Program Chairman for the '91 Technology and Innovations in Training and Education (TITE) Conference and Committee Chairman for the '92 Interservice and Industry Training Systems and Education Conference (I/ITSEC).

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INTRODUCTION

The use of the AIMS model for media selection is better understood in the context of where and how the selection occurs in the instructional design process. Figure 1 shows the Air Force five-step Instructional System Development (ISD) model. Except for placement of a few steps in the process, this is very similar to a generic ISD model used by most businesses and universities.

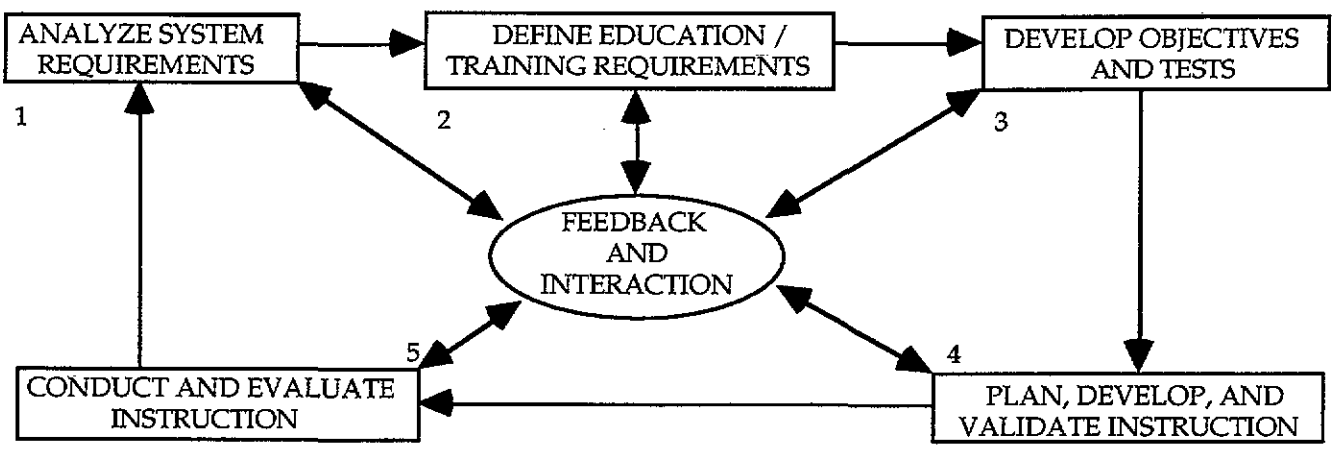

Figure 1. Air Force ISD Model

The information processed in the AIMS model is only as good as the quality of the data collected and analyzed in prior steps.

The following is a brief description of the critical data required from the ISD process prior to entry into the AIMS model.

- Analyze System Requirements. A detailed listing of all psycho-motor, cognitive, and affective skills required to accomplish the task elements of a job or mission.
- Define Education-Training Requirements. Translate task listing into Job Performance Requirements (JPRs) for those tasks selected for training. JPRs detail the specific behavior, the conditions under which the behavior is accomplished, and a standard which indicates how well the task/behavior is to be performed/accomplished. JPR support data include the specific skills, knowledges, and attitudes required to accomplish each task.
- Develop Objectives and Tests. Translate JPRs into objective statements, define the methods of instruction, and detail the evaluation methods. Support data for the objectives include a detailed listing of all instructional characteristics involved in the teaching of each objective.

This summary completes the first three steps of the five-step process and is sufficient data to enter instructional characteristics and objectives into the AIMS model. A parallel effort in technology assessment and media search is accomplished in order to arrive at a list of

candidate media to be loaded into the AIMS model.

MODEL SELECTION

More than 30 media selection models currently in use by the military services and non-military organizations were reviewed for use in the AFPATS program. Most of the models reviewed were based on either the original concepts or "spin-offs" of media selection processes proposed by Gagne, Reiser, Briggs, Rayner, Kemp, Anderson or Wager, all of whom are considered to be pioneers and innovators in the field of media selection modeling and applications. The purpose of these models is to provide a logical basis for matching training objectives with the most appropriate instructional media. During this review process, two facts became evident: 1) despite their fundamental similarities, most models are developed to satisfy the requirements of a particular training program, and 2) consequently, no two models are exactly alike. The AIMS model described in this paper is consistent with these findings. The basic framework of the AIMS model was applied to the specific needs and characteristics of the AFPATS Training Analysis database.

The model chosen for this project had to be:

- capable of handling the large media pool needed for a complete program of pilot training;
- a matrix model, allowing each objective attribute to be matched easily with the most appropriate medium;
- quantitative in nature, in order to generate interpretable ,rank-order recommendations for instructional media;
- automated and thereby capable of handling a large amount of data quickly and efficiently.

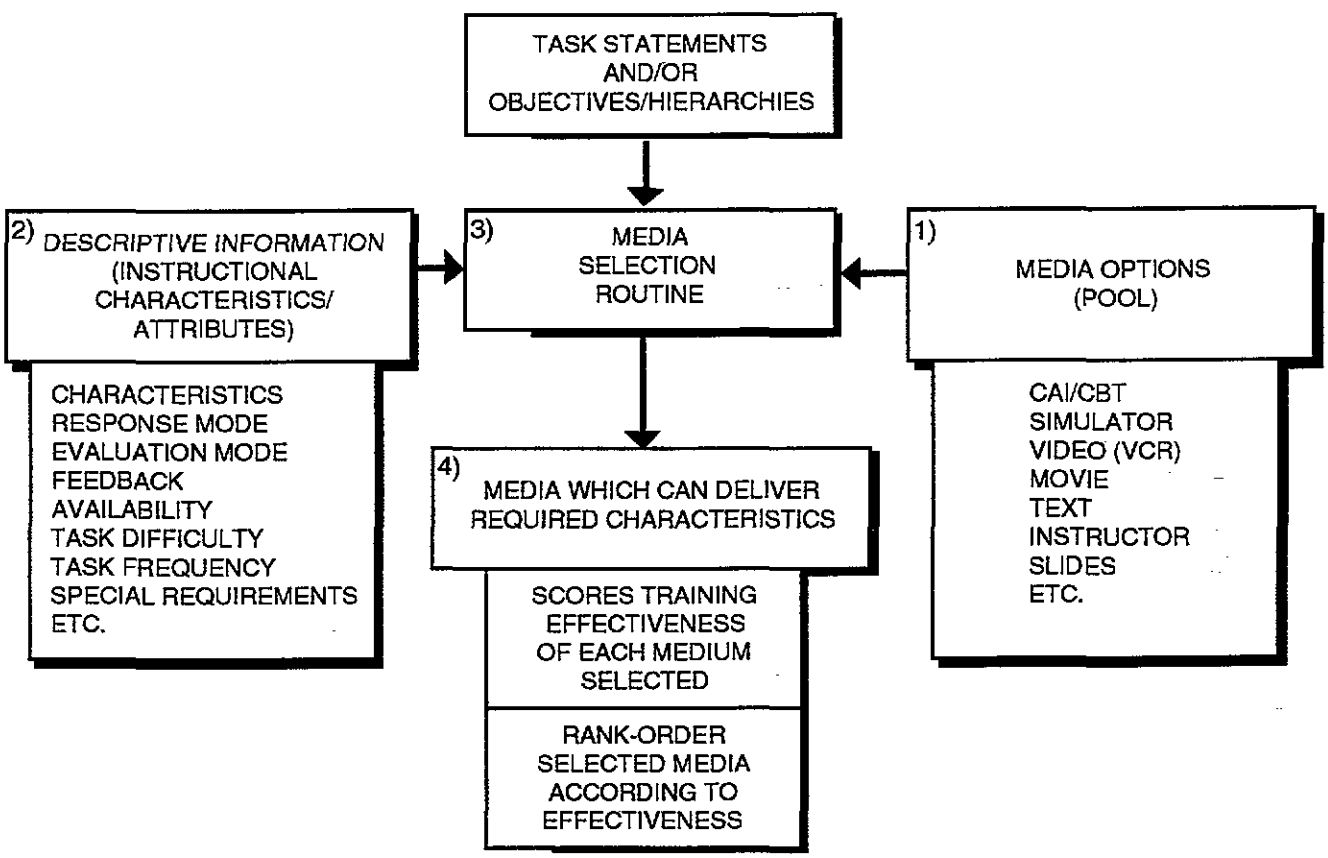

Figure 2. Automated Instructional Media Selection Model (AIMS).

The original AIMS model was developed by the Naval Training Equipment Center (renamed the Navy Training Support Center), Orlando, Florida, in 1983, for in-house use in developing curricular material for the various Navy training programs. The model has been revised and modified many times since 1983, but the basic premise and foundation of the model remain unchanged.

The AIMS model begins with the training analysts who, with input from subject matter experts (SMEs), determine three key components of the media selection process: 1) the set of attributes of all training objectives, 2) the best media pool for the given range of training needs, and 3) the extent to which each medium can address each attribute. Next, the automated part of the process allows the computer to integrate and tabulate this information, leading to a rank-ordered list of media recommended for each training objective. With these fundamental elements intact, the AIMS model was further developed and refined by training analysts and programmers at JWK for use in the Computerized Instructional System for Tasks, Objectives, Media, and Syllabi - Clipperized (CISTOMS-C) database system.

In Figure 2, the media selection routine (block 3) searches each objective (top block) for which instructional characteristics (block 2) are marked as required to teach that objective. The weight factors for the selected characteristics are then added to a total score for each candidate medium (block 1) in the media pool. The results (block 4) give total scores and rank order of recommended media for each objective.

MEDIA POOL

There were three primary data sources to determine which media would be included in the AFPATS media pool. The first source was information provided by the Technology Assessment performed for Training System Basis Analysis. The applicable areas of that report were extracted for use in the AFPATS media pool. The second source was a detailed review of the current training system achieved through interviews with personnel from the 338th Training Support Squadron at Randolph AFB, Texas. The final source of data input was technology reviews at the '91 Technology and Innovations in Training and Education (TITE) Conference and the '92 Interservice & Industry Training Systems Conference (I/ITSC).

The initial media pool included the types of media in use at Undergraduate Pilot Training (UPT), Pilot Upgrade Training (PUT), and Pilot Instructor Training (PIT) and potential media that may be selected for future use with the AFPATS aircraft. Data for the media pool are based on on-site visits to both UPT and PIT training bases, current related literature review, and information from subject matter experts (SMEs). One of the advantages of the AIMS model and the CISTOMS-C database is the ease and flexibility of adding and subtracting media to the media pool as revised data become available.

INSTRUCTIONAL CHARACTERISTICS/ATTRIBUTES

The ISD process yields very detailed task/behavior characteristics (attributes). These attributes are specific to each education or training program. In defining the appropriate training characteristics/attributes for use in the media selection process, the following points were considered:

- the relevance of the attribute to selected media in the media pool;
- the inclusion of attributes which identify the cognitive and psycho-motor skills required for task performance;
- the inclusion of attributes which distinguish between GBTS and performance objectives;
- the inclusion of attributes to address complex issues related to student pilot and instructor pilot training, such as situational awareness;
- the inclusion of attributes which address necessary crew/flight interaction and/or communication issues; and,
- the inclusion of attributes which consider the instructional method and method of evaluation so there is consistency in the media selected for a given objective.

The attributes chosen for inclusion in the media selection process are entered in a matrix with the media pool (see Figure 3). These attributes

were developed from standard instructional characteristics lists such as those found in the five step ISD process in Air Force Manual 50-2 (Instructional System Development). A subjective weight is assigned by SMEs to each medium attribute according to each medium's ability to consider the instructional attribute. The weights are assigned using a 0-5 scale where '0' indicates that the medium has no capacity for delivering this instructional attribute and '5' means that the medium is highly capable of handling a particular attribute. For example, an audio tape would likely receive a weight factor of '5' for the attribute of "aural cues", but should be assigned a weight factor of '0' for the attribute of "visual ground detail". The weight factors in this matrix are entered into CISTOMS-C, on a medium-by-medium basis, using the detailed task information taken from task analysis records.

INSTRUCTIONAL CHARACTERISTICS	Still Visual	Dynamic Visual	Wide Field of View	Vibration	Aural Cues	Forming Associations	Using Rules	Manual Dexterity	Affective Skills Training	etc.,	etc.,
MEDIA	1	2	3	4	5	6	7	8	9	10	11
1. Reference Text	2	0	0	0	0	5	1	0	1		
2. Lecturer/Facilitator	0	2	0	0	2	4	3	0	4		
3. Audio Tapes	0	0	0	0	5	3	0	0	2		
4. CAI (DMM)	4	3	4	0	3	4	4	0	3		
5. Aircraft	1	5	5	4	3	2	4	5	3		
etc.,											
etc.,											

Figure 3. Sample Media Matrix

In Figure 3, the vertical axis is a list of the candidate media collected from technology assessments and other sources. The top horizontal axis is a summary list of objective instructional characteristics. The grid contains the weight factors (described above) at the intersection of each medium with each instructional characteristic. Figure 3 is only a sample matrix. The AFPATS matrix contains 30 media and 80 instructional attributes. The process of weighting media against objectives is an automated process conducted within the CISTOMS-C media selection model. In this process, each objective is considered on an individualized basis. For a given objective, if an 'X' occurred in a database field identified as an attributed field, then the weightings for each of the media choices are calculated. Any attributes lacking an 'X' for a given objective are not included in the calculation process. At the end of this process, the user is provided with a listing of media, ranked from highest total score to lowest total score (the scores are provided for the purposes of showing the range

of numerical values). At this stage in the process, the instructional designer/training analysts can change the media decision generated by CISTOMS-C (i.e., disagree with the medium selected for a particular objective), and assign the desired medium in place of the medium assigned by CISTOMS-C.

MODEL MODIFICATIONS

The CISTOMS-C Media Allocation Report (MAR) ranks all media for all objectives. In the case of the AFPATS program, the objective data base was split between psycho-motor skills (Flight Training Objectives) and cognitive skills (Ground Based Training Objectives). Using the AIMS matrix as a guide, CISTOMS-C was modified to separately consider flight training and ground based training objectives. For reporting purposes, the data base was split between those media appropriate for ground based (academic) skills and motor (flying) skills.

Therefore, the media allocation report for flight training objectives reported only those media appropriate to flight training (e.g., aircraft, simulator, part-task-trainers, etc.,). Likewise, the media allocation report for ground based training reported only those media appropriate to cognitive skills training (e.g., lecturer, text, film, CAI, etc.,).

In addition, some modifications were made to the AIMS model because it is not an "intelligent" system. For example, some motor skills tasks have to be taught in simulation devices. Tasks like "perform ejection," "engage the barrier during landing," and "shut down the engine in flight" are not practical for training in the aircraft. The AIMS process of adding numbers to show hierarchy does not account for logical decisions. The AIMS model would tell you that the aircraft is the best place to teach ejection. However logical that may be, such a training strategy is not practical. Although not specifically done for the AFPATS GTBS, a modification to "help" AIMS make logical decisions would be to create a special instructional attribute (i.e. "safety" for which specific media (aircraft) would be coded with a '0'). The coding is such that if a medium shows a '0' for the attribute "safety," then that medium is excluded from consideration. Further, the ease of reporting recommended media by the AIMS model was facilitated by carefully listing the media in an order that permitted the split between psycho-motor and cognitive skills.

FUTURE MODIFICATIONS

The experience of the AFPATS Training System Requirements Analysis (TSRA) uncovered some additional modification requirements that would enhance the AIMS model for future front-end-analysis efforts. For example, splitting the media into psycho-motor and cognitive skills yielded more accurate and easy to read reports. The same concept could be used to include an option to split the instructional attributes on the AIMS matrix. The main purpose here would be to separate not only psycho-motor skills from cognitive skills, but to isolate affective skills as well. It could be argued that, if so many splits of the data base are required, separate AIMS matrices should be created. However, this would eliminate the reporting of all media against all objectives. Giving the analyst the option to split portions of the matrix offers more flexibility in generating reports.

In summary, the concept in the AIMS model is very useful in ranking candidate media for training psycho-motor skills. Modifications of the concept can be made for training cognitive skills. Some further development may be necessary for incorporating affective skills.

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