AVIATION CURRICULUM DESIGN

by

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ABSTRACT

Historically, aviation education has been in the hands of the pilot poorly qualified as an educator. With the explosion of knowledge in the past quarter century, it is imperative that aviation education be addressed by professional aviation educators.

The key to curriculum design is organization. There are many models for the organization of curriculum design. Examples are given of from three to sixteen steps. All may be apply to aviation curricula.

A seven step model of curriculum design is applied to the design of pilot curricula to demonstrate how aviation curricula may be designed.

Pilots should not find curriculum deisgn difficult, because they already have the ability to organize. The aviation curriculum designer must cross-qualify from aviation to curriculum design to full knowledge of resources such as funding and educational delivery systems.

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INTRODUCTION

Knowledge was expected to double between 1960 and 1967 according to Werner Von Braun, in his Libraries and the Space Age (Hass, 1965). This can be extrapolated to imply that knowledge has multiplied by another three and one-half times since 1967. Numbers aside, there is little question that the body of knowledge for which we , as educators, are responsible is growing very rapidly, and must be managed with increasing expertise and organization. In aviation education this is particularly true.

Aviation education, only eighty years old, has not come a very long way. To put it another way, the "art" of flight was passed from one minimally experienced pilot to another. With few exceptions, for the first four decades, "...flight instruction was often relegated to those aviation pioneers who were in urgent need of funds. Usually, flight instruction was simply a means to an end; its uncertain and sometimes meager income was often the only way a dedicated airman could pursue his profession...he often had only rudimentary knowledge of aeronautics of flight and knew even less about the principles and techniques of teaching" (Illustrated Encyclopedia of Aviation and Space) , 1971, p. 840). Today, the majority still fit this description, with the possible addition that they may also lack the maturity that comes with chronological age.

In aviation, as in every technological field, the body of knowledge is exploding, and instructors are having an increasingly difficult time staying ahead. It is imperative that we approach the problem as professional aviation curriculum designers. Design demands not only organization, but also maintenance of currency in the curriculum.

BODY

In order to contend with the aviation knowledge explosion, we must be well-organized. For pilots, that certainly is not a difficult task, since we are generally organized at least to the extent of following check lists and procedures set down for us. Checklisting can be used in developing curricula for aviation.

We can adopt any of a multitude of models for curricular organization. The models range from very general ones of four steps or less. One model presented by Dressel (1968, p.30-31), is:

1. Definition of objectives
2. Selection of Objectives
3. Organization of Experience
4. Evaluating the Impact

The four steps presented by Ralph Tyler (1950) presented in question form:

1. What educational purposes should we seek to obtain?

2. What educational experiences can we provide?

3. How can these educational experiences be effectively organized?

4. How can we determine whether the purposes are beign obtained?

Both of these models say about the same thing, and can be analogized to the check list for an airplane where, for example, Step 1 is "exterior inspection complete".

An even shorter model is John Goodlad's (1975)

1. Values

2. Educational Aims

3. Learning opportunities.

This model probably provides good points on which to meditate, but it doesn't provide enough "checklisting" for the aviator.

For those of us preparing curricula, the four-step model may not be complete, but it may be helpful for those times when we are simply thinking things through on a large scale.

When we need more definition, we can go to considerably more detailed models. One of the most detailed, and one which certainly requires a written copy when we aare working with it is

that presented informally by the Department of Educational Leadership of The Florida State University (1980). The fifteen steps presented are:

1. Identify the problem
2. Define the program purpose
3. Develop area analysis (demographic data)
4. Conduct needs assessment
5. Establish priorities
6. Set program goals
7. Examine alternatives and barriers
8. Select a course of action
9. Choose objectives
10. Identify resource requirements
11. Prepare implementation plans
12. Design the program
13. Implement the program
14. Monitor and evaluate the program
15. Design feedback and updating mechanisms

16. Modify the prgoram to improve results

Certainly, this model serves its purpose well, with its attention to detail. It can be analogized to a "nut-by-nut" preflight checklist. This is highly desirable for the beginner in curriculum design , and certainly provides te experienced curriculum designer with a quality control mechanism. Between the sixteen-step Florida State model and the three-step model of John Goodlad (1975) and the four-step models of Tyler (1950) and Dressel (1968) are numerous models of six to eight steps. These are the models which many people follow. Hilda Taba's (1962) model provides seven clear steps of organization:

1. Diagnose needs

2. Formulate the objectives

3. Select the content

4. Organize contents

5. Select the learning experiences

6. Organize the learning experiences

7. Determine what should be evaluated and the methods of evaluation.

We, in collegiate aviation, have an obligation to lead the aviation industry in curriculum development. We must be willing to change, to improve, and to perfect constantly. To do this we

must understand the curricular design models as they apply to us. Let's take the Taba (1962) steps individually and discuss some strategies for developing aviation (pilot) curricula?.

Step 1. Diagnose needs. Who wants it? and Why? Generally, we are responding to demands from the university or college, the community served, and the aviation community. The strongest demand from the aviation community seems to come from the Federal Aviation Administration (FAA). We don't move forward, except as an intellectual exercise, until we have determined that that there is a valid need for the curriculum we are developing. Someone wants it and has an acceptable reason.

Step 2. Formulate the objectives. What do we want from our curriculum? What do the others desiring the curriculum want? Are we training recreational pilots? Military pilots? Professional pilots? To what level are we training? Specifically define what the student will know and be able to do at the successful completion of the curriculum. This should be somewhat detailed since subsequent steps will be developed by specific reference to this step.

Step 3. Select the content. What elements must we cover to meet our objectives? Sources for this are demands of the FAA as found in regulations, and the Written and Flight Test Guide Advisory Circulars. With the elements required for civilian certification, we have a <u>part</u> of the requirement. We alsomust consider the elements we have determined are necessary from our

own experience, and from the experience and demands of others in all areas of aviation. One method which provided a listing of content for pilot training up to the specialization level was to derive a list from FAA Written and Flight Test Guides through the Instrument and Commercial Pilot levels, and from curricula of the Navy, Air Force, and three university schools. The outcome list consisted of 765 elements. Since some of these elements clearly did not apply to civilian flight (formation flying, for example), the list was evaluated with a Delphi Survey of a panel of twelve aviation education experts from representative areas of the aviation industry. Ninety-four percent of the elements on the list were validated for pilot training up to the specialization level (McDermott, 1983). This strategy for determining the content of a pilot curriculum, though time-consuming, provides some useful insights for the pilot curriculum developer. The same method, with or without the Delphi mechanism, is appropriate for updating the curriculum alluded to in Step 7.

Step 4. Organize the contents. Is there a logical sequence of instruction to follow? In aviation, there is generally a fairly clear definition of organization of content in pilot curricula. You certainly wouldn't attempt to cover ILS approaches before you covered straight-and-level flight, for example. There are, however, some grey areas in aviation curriculum content organization. These areas demand a little more time and attention to organize. These areas are subjects as diverse as regulations, flight computer operations, medical

facts, aerodynamics, and documentation. You must make decisions about the sequence in which you will present each broad category, and then the sequence in which you will present elements within the category. Tradition is invaluable here, but cannot replace the willingness to try new axproaches to sequence of learning. Particularly in the collegiate aviation school, experience and experimentation go hand-in-hand.

Step 5. Select the learning experiences. What methods are best used to assure that the student will master the subject quickly and thoroughly? This area is one where the university and college aviation curriculum designer really diversifies. We must have reasonable knowledge of all of the resources available, ranging from sophisticated flight trainer/simulators to simple mock-ups. Of course, aircraft play a large role, too. Thm curriculum designer must be familiar with all of the delivery systems available, locally and on the market. Since this is a dynamic area, ever-growing, it requires considerable effort just to keep abreast of the "state of the art".

The ubiquitous chalkboard is always a part of an education delivery system, but even that is improved with a "marker board" on which the user writes with variable-colored felt tip markers, and projects images wither with a slide projector or an overhead projector. He then can write directly on the projected image. These systems are only the tip of the iceberg of delivery systems available. With today's technology, we have video systems available, and computer systems, and computer-video systems. The

computer-laser-disk "Star Wars" game that is currently the rage in video arcades has enormous potential in the aviation learning setting. It is incumbent on the curriculum designer to understand the delivery systems, to choose the best for the learning situation, and to compromise this only with availability of resources. His resourcefulness will certainly reduce the need to compromise.

Step 6. Organize the learning experiences. How may we arrange the learning experiences to follow the pattern established with the organization of content? If the contents are well organized, and the learning experiences are well determined, this step may be fairly routine. To be considered should be such things as scheduling, so that equipment and instructors are not over-booked. This often requires a rather complex choreography to optimise use of these resources. Maintenance for all mechanical parts of delivery systems must also be planned. Part of this organization must take the human element into account. What can the student best deal with, and when can he best deal with it? For example, should the new student go first to the airplane for an introductory flight, or should he have a full-fledged lesson with specific learning outcomes, or should he have the first lesson in the simulator, where he learns only about the operation of the aircraft? The choices at every step are numerous. The above example demonstrates that the selection of the learning experiences and their organization are closely intertwined.

The curriculum must deal with educational philosophies, and balance them against the more mundane consideration of resources and finances. If money is no object, the latitude in organization of learning experiences, and the selection of them, is quite broad. When, however, the designer is dealing with limited funding either from the student, or from another resource, he must frequently compromise the ideal with the realistic. The ideal may be considered to provide "integrated" instruction, wherein academics and in-flight experiences are interlaced. The cost to the institution or the student may dictate that the academics be totally separated from the in-flight experiences. Frequently the choices are far from easy.

Step 7. Determine what should be evaluated and the methods of evaluation. Is the curriculum working? How can we find out? How well is it working? This step is as important as the six preceding steps. The curriculum must be validated to assure that it is providing the results for which it was designed. In aviation the success of the curriculum is critical. Flaws can be expensive in lives and money. Clearly, the pilot completing the curriculum must be able to demonstrate skills, and there are many ways to test this, the most popular being the check flight. The acquisition of flight time or experience is not enough. Demonstration of specific skills is mandatory. But there is not enough time, nor are there enough resources, to demonstrate all of the skills a pilot must acquire, so selection of those skills which incorporate other skills, and optimise the check flight is

imperative. For example, a perfectly executed instrument approach unequivocally demonstrates the pilot's ability to fly the airplane in straight-and-level flight, in climbs, glides, and turns with reference solely to the instruments. But, must the approach be perfect? That is a question in all evaluation. What are the criteria which establish acceptable performance? Again, the curriculum designer must spend considerable thought.

Determining the student's success in achieving the goals of any curriculum in only half of the evaluation process. The program must, itself, be evaluated constantly. Expecially in aviation, which is so dynamic, the curriculum must be evaluated constantly to assure that every thing new is covered. One method is to review all documentation originally used to provide the content for the curriculum, and glean any new elements. This, combined with review of all current aviation literature, assures better currency. Perhaps a survey of aviators to learn their ideas will strenghthen the evauluation of content. Feedback from students who have completed the curriculum and have experience in the field is slow, and lags behind other methods of gaining information, but it has its uses in curriculum evaluation. In maintaining the recency of the curriculum, the designer has an ongoing job.

CONCLUSIONS

Designing an aviation curriculum is not unlike designing any curriculum. The aviator would not attempt to design a curriculum in psychiatry unless he is also a psychiatrist. Aviation curriculum designers must be aviators. They must also be cross-qualified in curriculum design. Attaining this skill ought not to be difficult for the aviator. The ability to organize already exists. The curriculum designer has many models from which to choose. Some are perhaps too simple for effective design, especially for the neophyte. When the aviation curriculum designer chooses his model of design, he is well on the way to an effective curriculum. Of course, the curriculum designer must know his resources as well as his subject.

No step in any curriculum design is totally independent of the other steps. At the very least, decisions made in later steps may require the alteration of an earlier step. The designer should be fully prepared to this to happen, and should respond accordingly.

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