Povenmire's Seven Golden Rules of Instruction
by King Povenmire DPE

Every so often I have had a dramatic moment of insight. These have come to me one at a time after beating my head against a problem for so long that I finally took time to look at it.

The mental process which produced these insights is like that of the golfer who kept making stupid mistakes. His buddy has sold him several "smart pills" during their round. He bought one more, just before his 18th tee shot. Before he swallowed it, he took his first good look at it. All of a sudden it came to him. He said

> "Hey! These aren't smart pills, these are rabbit pellets!"
>
> "Now you're getting smart!" said his good buddy.

According to the FAA Aviation Instructor's Handbook, this is called "gaining an insight."

Well, here are these seven golden insights that I want to pass on to you. They are consistent with modern philosophy of education and with psychological theory. Granted, in pilot training we are primarily teaching motor skills, but the same concepts work for any teaching endeavor.

ONE - STATE YOUR OBJECTIVES IN BEHAVIORAL TERMS
This is the first concept, because it is most important. For decades, instructional managers have been concerned with the objective of instruction. Every Friday, elementary school teachers were required to submit their next weeks "objectives" to the principal. The principal was usually satisfied with "Social Studies: Cover Peru." or "Math: Work on division of fractions." One day a visiting lecturer brought a revolutionary idea to our school. We should state our objectives in terms of what the student would be able to do rather than what we were going to "cover." I had a perfectly good idea about what my sixth graders would be able to do after we were finished - move on to the seventh grade.

His idea impressed me. After his presentation, I asked him to help me try to modify my objectives into behavioral expectations. It wasn't easy at first. My old concepts kept getting in the way. He kept badgering me to tell him exactly what I expected my students to do after studying Peru. I came up with things like "be able to appreciate the culture of Peru." or "be able to understand the Peruvian people better." These were not specific enough for him.

> "How will you know when they 'appreciate' or 'understand?' What should a sixth grader be able to do about Peru?"
>
> "Well," I said, "They sure ought to be able to pass the test that I will give on Friday."
>
> "Good! What kind of questions are you going to ask?"

Now if you have never taught school, you may not know about "Thursday Night Panic" That is when the teacher realizes that an unwritten test is scheduled tomorrow. (Why do you think so many questions are direct quotes from the text book?) Now this fellow wanted me to write the test right now!

It took some thought. Eventually I wrote down a list of questions such as:

1. Name three major cities in Peru including the capital.

2. Name three major exports of Peru.

3. Name three major imports of Peru.

4. Describe the various climatic regions of Peru.

Then this brilliant consultant - whom the school district had paid an exorbitant sum - simply put this phrase at the beginning of each question - "AT THE END OF THE LESSON, THE STUDENT WILL BE ABLE TO:"

All at once it hit me. It is OK to teach the test if the test evaluates all required aspects of the skill. I can cut out a lot of filler and concentrate on the important material. Not only that but I can relax on Thursday night.

In a fit of excitement over the new idea, I started off on Monday morning by reading the objectives for the week to the class. As I set aside my list and reached for the text book, three students got up out of their seats.

> "Where are you going?" I asked.
>
> "I'm going to get the Atlas." said one; "I'm going to get the encyclopedia." said the second; and the third said "Hey I'm going for the encyclopedia.

In a gesture of submission and approval, I just raised my hands and stepped back. All I did for the rest of the day was to provide resources, suggest study groupings, and answer questions.

By Wednesday, after the "Life in Modern Peru" film, the class agreed that they were ready for the test. Now what? If I gave the test now, what would we do for the rest of the week? Perhaps my objectives had been too short-sighted. Maybe sixth graders should know more about Peru. After a short period of second guessing, I decided that the objectives had been at least as comprehensive as the text. I decided to spend the rest of the week on Argentina, and handed out the test.

Neither I nor the students (and certainly not the principal) were ready for the results. My class usually settled into a normal curve with three or four A's, ten to 15 B's, 20 or so C's, and two or

three below that. The lowest score was 90% with the average at 95%. What could I do? I gave them all A's.

"Well of course!" you say. "You taught them the test." But when you think about it, that is just what we should be doing. The only requirement is to be sure that the test covers the entire realm of the desired performance of a well trained person. In pilot training, it is not enough to make 70% on such a test. All skill, knowledge and judgment objectives must be met.

In applying this concept to pilot training, we need to list all the tasks that a pilot needs to be able to do, then figure out how skill at these tasks can be tested. We must take care not to leave out a critical task. Higher level skills do not always fit easily into this format, and must be worked out carefully.

With a little practice we can make up behavioral objectives for any situation. Before I meet the student I formulate objectives for the flight. When I meet him, I say "Okay Orville, last time you were having trouble controlling your airspeed on final approach. By the end of today I want you to be able to keep it between sixty and sixty-five." Orville knows what I think is important for the flight, and will concentrate on learning it.

Over the past 20 years, behavioral objectives have found great acceptance among education and training professionals. They have even found favor in some public schools. Some teacher's colleges may never get the message.

I lived in Alabama while two of my children were growing up. When we first arrived, education in Alabama ranked forty-ninth. (Mississippi was fiftieth.) Shortly afterward, Alabama decided they were not going to promote students to the next grade unless they possessed the required basic skills. "Criterion Referenced Tests" were developed. Passing these tests in all subjects was required for admittance into the next grade.

The first couple years were eye-opening. One of my son's senior year classmates was a senior for the third time. There were a lot of disappointed parents, students and especially teachers. There were also a lot of tall second and third graders.

Now it didn't take "Miss Burnside" long to figure out that "Bubba" was going to be back in her class for a third time if he failed multiplication again. So she made a special effort to see that Bubba knew all the skills that were tested on the Criterion Referenced Test. She basically wrote a behavioral objective for each concept tested.

A few years ago I saw that Alabama's school system had moved up to twenty-fifth. (Mississippi's was still fiftieth.) There may have been other influences, but I believe that the Criterion Referenced Test and the resultant drive toward behavioral objectives was a major one.

TWO - REMIND THE STUDENTS OF THEIR OWN MOTIVATION
This one came to me very young as I sat unhappily practicing the piano. It was a beautiful Saturday morning, and my friends were all outside playing baseball.

YOU CAN NOT TEACH ANYBODY ANYTHING IF THEY DO NOT WANT TO LEARN. It does no good to provide the best possible instruction. You can not project your own motivations onto the student. Unless the instructor can show students how learning will enhance their own goals and values, the will not learn.

To succeed in this, instructors need to be like (are you ready for this?) used car salesmen. Have you ever walked onto a used car lot and gone directly into the glass building to ask if there is a salesman that can sell you a car? No. We usually sneak onto the corner of the lot to get an uninterrupted peak at an "attention getter" parked strategically on the corner of the lot. The salesman is watching from behind the window like a fisherman. After a polite interval, the door swings open and here he comes - straw hat, cigar, red blazer, yellow pants, white shoes and belt.

Now put yourself in his shoes for a minute. If he is to be successful, what is the first big question in his mind? "Why did this person walk onto the lot?" Have you ever been asked, "Are you married?" "Do you have any kids?" Do you drive a lot in your business?" He is building himself a catalogue of your motivations, which he will be able to drop back on you at the appropriate time. "Do you think the kids will like all that room?" or "You'll save a bundle on fuel over what you are driving now."

As instructors, we need to borrow this technique. I usually ask my students why the want to learn to fly. One told me that he wanted to become an airline pilot. Later on in the traffic pattern I was able to say "Airline pilots fly very precisely. See if you can hold your altitude within 50 feet." Another told me that he wanted to be an aerobatics champion. "Aerobatics requires precise aircraft control. See if you can hold your altitude within 50 feet." A third said he wanted to be an aerial applicator (crop duster). I said "Crop dusters have to be able to control their altitude within - uh - well never mind, just try to keep within 50 feet on down wind."

As it was with me learning the piano, it would do no good to tell the future aerobatics champion that his passengers would not like his abrupt maneuvering. He would react more favorably if I mentioned the smoothness required in aerobatics maneuvers.

Some learning activities can be quite remote from anyone's goals and values. The commercial maneuver "On-Pylon Eights" has no apparent practical value. Students often ask "Why do I have to learn this?" Two answers are acceptable. "It will help you recognize unsafe situations while showing people something on the ground." or "You have to do it to pass the check ride." Either answer directs the students to their own goals and values.

I wish I had learned to play the piano.

THREE - CONTRIVED EXPERIENCE

We have all heard that judgment is un-teachable - you either have it, or you don't. That's not true. Judgment can be taught. We've all heard "Judgment comes from experience." Instructors should construct their lessons so as to provide experiences. In the 1964 version of the FAA Flight Instructor's Handbook AC 61-16A which has been superseded by the Aviation Instructor's Handbook AC 60-14, there was a brief discussion of a concept entitled "Contrived Experience." Some bureaucratic nitwit took it out of the latest version.

Students learn from experience. Instructors should guide that experience. Too often in training, students are told what to do on every flight - even solo flights. They never get practice making decisions. Their only experience occurs on solo flights. Instructors should figure out ways to allow students to make decisions during all flights. As soon as students have learned the basic knowledge required to make decisions in a particular area, they should be allowed to do so.

Rather than ask for a Short Field Takeoff, the instructor should ask the student to pretend that there is a 50-foot obstacle at some point near the published minimum takeoff distance. At that point we must be 50-feet above the surface. The student should respond by looking up the takeoff performance, provide a fairly accurate estimate or measurement of the runway available to the imaginary obstacle. The student will also learn first-hand about performance deterioration due to older engines and dirty airfoils.

"This time I would like you to land as if the runway was covered with tall grass." This will allow him to decide which kind of landing to perform rather than to be told to "Do a Soft Field Landing."

"Pretend that there is a serious accident at that intersection and you are relaying directions to the enroute ambulance." The student is now free to decide to do a Turn About a Point, or meander aimlessly around the area, losing site of the intersection.

This type of instruction forces the student to decide which type of maneuver to do, just as in the real world when the instructor is not there. Serendipitously, it is much more fun for both of you.

It is possible to overlook an important behavioral objective by using this framework for learning to fly. It is of utmost importance that students learn to perform the maneuvers listed in the Practical Test Standard (PTS) when requested by the examiner. They should be able to recognize the maneuver by the name in the PTS.

Judgment can be fostered in other areas as well. Once the student learns basic VFR cloud clearance requirements it is fair to ask for a climb to 3000 on a day when you know that the clouds are at 2500. If you get too close to the clouds you may ask "How close can we legally get to the clouds?" If the right answer is provided, you may provide some practical experience at estimating the distance from clouds.

If the clouds are in uncontrolled airspace, and both you and the airplane are IFR legal, you might not say anything until everything turns white. An immediate decision to reduce power and

descend should be rewarded. If there is a moment of hesitance, you should take over, and demonstrate what you would do in this case. Although this is legal, you should take reasonable precautions that nobody else is doing the same thing at the same time.

If the mag drop is more than the maximum allowed, sit quietly and see if the student questions it. If not, there is an opportunity for instruction. Depending on the level of experience, the decision on what to do should be left to the student.

HOW TO CRITIQUE JUDGMENT

Critiquing a person's judgment is a very delicate matter. People are very ego-involved with their ability to make good judgments. The secret to an acceptable critique is to start by saying "The decision you made was a good one based on the factors you considered. This is always categorically true. Nobody ever makes a bad decision o purpose. "However a couple things come to mind that you might not have considered."

Then the instructor can provide additional data which might change the student's mind. During a night flight, my advanced student noticed that the white position light on the tail was out. I acknowledged, but continued to untie the aircraft. He was anxious to get this instrument flight out of the way because it had been hard to schedule. (This fact should have had nothing to do with the decision.) He decided to fly because the rotating beacon was on the tail, and provided enough illumination for other aircraft. I told him "That is a good decision based on most of the facts, but the various colors of the position lights indicate our aspect to other aircraft."

Nearly as often the student may say "I thought of that, but ..." and provide additional data that I had not considered. Virginia was working on her instrument rating. She was finally ready for serious instrument cross-country work. We went from Mobile to Tallahassee for fuel, then on to Ft Lauderdale to attend a two-day aviation course before returning to Mobile.

As we prepared for the return trip, she brought her flight planning data to my room and pointed out that if we went to Tallahassee we would not have a suitable alternate within our fuel range. However, if we fueled at Gainesville, we could use Tallahassee as an alternate, and still be able to fly from Gainesville to Mobile with a suitable alternate. I congratulated her on her decision, but wanted to make sure she understood that with the weather conditions we had been experiencing that an alternate might not be necessary. She said "Yes, I thought about that, but ..." At this point she turned her flight plan form over and said "Tropical Storm Bob is forming in the Northeastern Gulf, and ..." Needless to say we went to Gainesville.

If the student routinely makes decisions that are overly adventurous, the instructor should "counsel" the student as to the possible consequences of his risks. In one radical case I refused to fly with the student, or to sign him off for solo, even though he was technically capable. If the student is overly cautious, the instructor should try to help the student understand the reason behind the fears, and to provide real world information or vicarious experience to counteract them.

FOUR - SEEK AND GIVE FEEDBACK

Did the student understand what I said? How can I find out what he perceived? and Does the student know what I thought of the attempt. These are the three central questions which help structure feedback. When talking before a large group we often look for signs that at least some people understand. If it is important that everyone understand, then we must give a quiz. When talking to one student we can form questions that will tell us whether the correct concept was received.

One major roadblock to learning is the illusion on the part of the instructor that it has occurred. "I told him and told him, and he still did it wrong." Simple feedback techniques, such as "OK?" and waiting for a nod can promote this illusion. Think about it. It is expected that you will nod your head when someone says "OK." It is expedient to nod, rather than incur a disgusted glance, a deep breath and another explanation. Often the student will nod in good faith, not realizing that only a portion of the concept was understood.

When teaching to behavioral objectives it is imperative that you measure the result. Did the student meet the objective? This requires feedback to be structured and organized to show when the student is ready to move to the next objective.

FOLLOWING A WRONG CONCEPT

I have learned to recognize an important clue indicating that a student is following a wrong concept. If I ask for something simple and straight-forward and the student looks quizzical, there may be either a miscommunication, or the student has the wrong basic concept. My request doesn't make sense within his frame of reference. For instance, when I asked a student to climb to 3000 feet, he looked quizzical, hesitated, then asked "How high is it where we need oxygen?" He showed good judgment in checking, but his ground school lesson had been incompletely learned.

A wrong concept may be indicated if the aircraft is doing funny things. Many students have trouble on final because they don't use the rudder correctly. To see how this looks, make an approach with your feet off the rudder pedals. One student kept increasing the left rudder trim on a cross country flight even though the right wing continued o get lower and lower. I asked him why he was trimming the ball so far out to the right? He said he was just cranking in the cross-wind correction. "If you put in just enough trim" he said, "you will go right down the course line.

One student came completely unglued when I demonstrated a stall. He was an engineering student who had observed destructive testing of metals. He said "I've seen how a bolt hole will elongate just a little bit - then it fails catastrophically, and I know how old this airplane is." After I explained my own confidence in the inspection procedures, and how they are designed to catch early indications of impending failures, he was able to do stalls without ceasing to breathe. It took quite a lot of experience before he was totally comfortable, however.

POSITIVE FEEDBACK

If we fail to praise good performance, we miss out on one of the most powerful teaching tools available. When using behavioral objectives there is a tendency to give only corrective feedback until the objective has been met, then go on to the next objective. Instructors often look only for the final criterion, and take it as an expected occurrence. The student, on the other hand, has been wondering if he will ever master this task. Intermediate criteria must be used which can be achieved on each flight. We must praise everything that the student does better than at the beginning of the lesson.

I had been worried about John. Although he was using his VA benefits to pay for his commercial pilot course, he seemed timid, cautious, and quite nervous during every flight lesson. His progress was very slow, and he did not have a desire to use his piloting skill after he finished the course. One day he performed a Lazy Eight exactly the way I believe it should be done. I said "John, that was the best Lazy Eight I have ever seen! That's the way I would like to do it on my best day! I reached across the cockpit and sincerely shook his hand. Then I said "Do another." He did! I rejoiced out loud. I followed it up when we walked into the operations office. The pilot examiner and two other instructors with their students were standing around as John completed the paper work. I said to the pilot examiner "Len, you should have seen the Lazy Eight that John just did. When you give him his check ride he will show you how I believe they should be done." The effect on John was unbelievable. When he showed up for his next lesson, he was an eager learning machine. After passing his check ride with flying colors, he bought his own airplane for "family travel and personal fun."

FIVE - VERBALIZE THE CUES THAT YOU USE

This is a skill that expert pilots do not need, but instructors do. There is a poem that makes this point very well.

The centipede was happy quite until a frog in fun
Said pray, which leg comes after which?
This raised her mind to such a pitch
She lay prostrate in the ditch considering how to run.

Anon.

Instructors have to be able to explain how they do something. One time I watched an instructor from the back seat. On the downwind leg of the traffic pattern his student was slowly losing airspeed and altitude. The instructor tapped the throttle. The student looked the throttle, then at the instructor.

The instructor should have pointed to what he was looking at that told him that the throttle needed attention. Ask yourself "How do I know that an error is being made?" That is what you should point out to the student.

When I was a budding pilot, Charlie Cordell was my aviation hero. He had flown many different types of fighter aircraft, and continued to fly his own silver Navion for both business and pleasure simultaneously. One day he invited me along to look over some property in the coastal mountains. As we headed for the mountains he asked me whether the distant mountains were becoming more, or less visible behind the nearer ones? It looked to me that they were sinking behind. He chuckled and said "That's how you can tell that you can't climb over them." and began a slow circle to gain altitude. I have used that cue many times, and have passed it on to all my students.

How do you describe the cues that tell you that you need to add back pressure in a turn? What tells you that the airspeed is going to start bleeding off on final before it actually does so. The problem is that these cues have been internalized to the point that you can't even describe them.

Frank, one of my best friends, was a helicopter instructor pilot with the Coast Guard. We ere discussing an article about helicopter pilots becoming disoriented while hovering over open water at night. (It sounds scary, but they do it.) He told me that he could tell when a student was going to start backing down even before the aircraft started to move.

> "That's good, Frank. How do you tell?"
>
> "Over the years you develop a 'feel' for it."

That was my cue. "That's not good enough, Frank. You only have five senses. You have to be sensing something that you have internalized. If you think about it a little, you should be able to tell me about it."

> "You don't know what I'm talking about unless you've been off shore at night - until you develop a feel for it. It just comes to you."

After a half hour of this type of argument, he finally looked at the ceiling and said, "I guess it feels like you are leaning back in your chair."

> "Very good Frank. If I'm ever off shore at night (fat chance) I will be conscious of that feeling.

The next day Frank came into my office. He said that he had had a student out off shore that night, and when he pointed out the cue, the student stopped backing down!

As it was with my friend, Frank, this is a difficult thing to do. For example, most people know how to ride a bicycle. I hesitate to use this example in print, because several of my audiences have gotten so belligerent that they have resorted to mob action, carried me outside and put me on a bicycle to prove it. The problem is posed: "If you are riding fast enough to be fairly stable hands-off, and you put just a little bit of forward pressure on the left handle bar, which way does the bicycle turn? (Remember, just press the handle bar, don't lean.) Unless you have analyzed

this, or have been taught better, most people will say "to the right." Wrong. Nearly eighty-percent of the people I have asked get it wrong.

Well now that I have destroyed my credibility with eighty-percent of you, let me try to redeem myself. Have you ever been so close to the right curb that you had to use "Body English" to get away? If you try to do the normal thing - push the left handle bar a little bit - you will climb the curb. If you push the right handle bar, you will fall into the curb.

One guest at a friend's house stood up abruptly, and stormed out of the house. (To add the proper emphasis to this story, it was winter in Kodiak Alaska.) I apologized to the host, and we went on to another topic. A few minutes later, the guest came back into the house with a bicycle! He had been riding around outside and still didn't believe me. I declined his offer to demonstrate in the living room, and helped him get the bike back outside. Before I got on, I showed him his tracks in the light snow. Before a bicycle turns left, the front wheel makes a big loop out to the right. He finally had an insightful realization. He said "Son of a gun!" Then we went back in and finished our coffee.

Frank had moved away for four years and had been promoted to Commander. When he returned, he recalled our argument, and said that this concept was the most important thing he had ever learned about teaching flying. He explained how he applied it to other maneuvers, and told me how he extended the concept. "If I can't tell why a student is messing up, I will fly the maneuver and ask myself how I know when to move the controls."

That's all there is to it. In fact if you do not do this, you are wasting your student's time and money.

PASSIVE REHEARSAL

Imaginary cues can be as valuable as real cues. If student can visualize themselves in flight, they can practice a maneuver while waiting for a green light, or during TV commercials. We have all used this "armchair flying" to imagine our responses to serious emergencies. Students should be asked to practice specific things in the privacy of their own mind.

When Bob came out for his weekly instrument lesson he always began as if he hadn't learned a thing during the last one. We would start over. His cross-check was as slow as it had been at the beginning of the last flight. I told him about the famous experiment where two groups of boys were taught to shoot basketball free-throws. One group was given daily practice on the court, while the other was given the same amount of time sitting in a quiet room, trying to imagine themselves at the free-throw line, aiming and shooting. At the end of the experiment, the real practice group did better, but the imagination group had improved without ever having touched a basketball.

I told Bob to imagine himself in this airplane on a heading of 030 flying over a familiar landmark at 3000 feet. Imagine what the attitude indicator looks like - the altimeter - the heading

indicator. Every time you look at the altimeter, it is 20 feet off. Look at the attitude indicator and make a correction. The same with the heading indicator.

At the next weekly lesson, he had not only maintained what he had learned that day, but had improved greatly. I use this on any student that can only fly once a week. I call it Mental Homework.

NONVERBAL CUES

In addition to identifying your cues, it is important not to become a cue yourself. One time on a dual cross-country, I noticed my student looking down at his chart. I sat curiously waiting for him to notice as the airplane turned slowly to the left. After a time, he looked over at my knees, then looked up and returned to level flight. I realized that I was trying to push the plane back on course by pressing both of my knees hard against the right side of the cockpit wall. All he had to do was wait until his instructor became uncomfortably contorted to tell when to look up. I have since learned to sit comfortably, and just go where the airplane goes.

Once there was an airline pilot who had failed the vision test for his FAA medical so badly that the doctor said:

> "You can't see anything past the windshield! How have you managed to fly?"
>
> "Simple" he said. "I just watch the instruments. These young copilots can see really well and they look outside."
>
> "But how can you tell when you're going to touch down?" said the doctor.
>
> "That's the easy part. I just follow the ILS all the way down until the copilot takes a quick deep breath, and then I flare."

I'VE GOT IT - YOU'VE GOT IT

There are very few times that an instructor must make control inputs during student practice. It may be appropriate during short final when speed is decreasing, or just prior to touchdown, or during tail-wheel ground operations. In most cases it is better if the instructor takes over total control at that point. If the student feels you on the controls there are two messages that come across. One is "I don't know what the airplane feels like without the instructor." The other is "I'm not good enough to keep from killing us. The instructor always has to save the airplane."

Instructors often ride the controls subconsciously. They try to coach the performance with their hands instead of their voices. Even FAA inspectors must guard against this. My friend, a Designated Pilot Examiner was taking a standardization check from an FAA inspector in the Stearman. As they taxied out, my friend felt the inspector on the controls, and let go. Without any input from him, the Stearman taxied smoothly to the run-up area, turned into the wind and stopped. The stick came back, the throttle was advanced to 1700 RPM and the mags and carb

heat were checked. After the trim was set, the Stearman started rolling again, and took off. Passing mid-field down-wind, the inspector hollered into the Gosport for my friend to do a wheel landing. My friend in the front cockpit nodded his head as the carb heat was turned on, and the Stearman made a beautiful approach to a perfect wheel landing. When the inspector commented on what a good landing it was, my friend turned around with both hands in view and said "It ought to be, You did it!" There was a little sashay because the tail was still in the air, but the inspector mentally "took over" and brought the big biplane to a safe stop.

SIX - CRITIQUE THE PERFORMANCE AND NOT THE STUDENT

I first learned this from my Child Psychology professor. She said "If you tell 'Little Alphonse' that he is a 'bad boy' he will soon believe that he is a bad boy. But if you tell him that he is a good boy, but what he is doing is bad, he will feel better about himself."

Looking back to concept number one, we have to remember that the conflict is between the student and the objective - not the student against the instructor. Which would you rather hear as a student? "That maneuver was unacceptable," or "You are unacceptable." Separating the student from the performance takes conscious effort. You may think "This stupid jerk is such a ham-fisted ..." but you must realize that he is really trying to do what you want him to do. After all, he's paying you.

SCREAMERS

Instructors have gotten frustrated after they "told him and told him and he still did it wrong." Let's face it. If he's still doing it wrong, it is because either 1) he doesn't understand the objective, 2) he doesn't see the cues that you use, or 3) he doesn't want to learn - not because he is diabolically trying to ruin your day. When instructors get frustrated they must try to determine which reason applies, and try a different angle. Students don't do dumb things on purpose.

PEOPLE WHO SHOULD NOT LEARN TO FLY

At this point it might be good to talk about the one-percent of people that should not fly. I have asked people representing many aviation organizations armed services and airlines representing many countries. It seems a general consensus that one-percent of the pilots don't have what it takes to fly airplanes. I have been involved in observing, evaluating and counseling some of these pilots, and have become quite knowledgeable about their individual problems.

It seems that one thing they have in common is that they are unable to quickly change their priorities. This has nothing to do with their IQ or judgment. Some very intelligent people take forever to make up their mind. Some people must see everything in place before proceeding to the next step. Pilots must make decisions based on incomplete information.

Such a pilot may ask unrelated questions just as the needle comes alive while intercepting the localizer course. One student started a long discussion on why the bearing selector doesn't affect the localizer course rather than turning to intercept. Often a pilot can describe an emergency

procedure perfectly, but they cannot do it. When asked to recite the emergency procedure, their mind goes to the proper page in the handbook. They read what's there, rather than imagining going through the procedures in the aircraft.

Often this person lacks the ability to visualize. This lack eliminates the possibility of mentally rehearsing between flights. There is an experiment that you can do to see how well you visualize. This is by no means a valid test of piloting skill, but it is fun.

Imagine a cube, each side is a different color. Now dissect the cube once vertically, again vertically at 90-degrees to the first, and once horizontally. How many small cubes do you have?

Now take one of the smaller cubes and tell me how many surfaces are colored? So much for the mathematical part. There are eight cubes and three surfaces on each are part of the original exterior. This can all be done in the abstract using mathematical principles. Now let's examine your visualization. There are no right answers to the following questions.
What colors were on the outside of the cube?

What color was the inside?

How did you dissect it?

Some people may be able to answer only one or two. It depends on how hurried they were. It is of course most efficient to imagine the cube dividing itself rather than taking it to a band saw. One person said that the inside was wood, and he remembers sawdust as he "dissected" the cube. The real died-in-the-wool visualizer will only be able to name three colors. There others were hidden.

Another indicator of possible difficulty is a history of perceptual problems as an adult. Researchers tell me that one's perceptual framework is pretty well established by the age of ten, and virtually unchangeable after 20. People with perceptual problems have trouble reading maps, drawing pictures of how the runway looks on final, or recognizing the cues that you point out. Although it is possible for them to learn to fly, they may be unable to recognize subtle differences between situations.

Remember, ninety-nine percent of people can learn to fly. If "Amelia" is having difficulty, it is probably because she needs a more efficient way to learn. Either she doesn't understand the objective, she doesn't see the cues that you use, or she doesn't want to learn.

SEVEN - DON'T SURPRISE THE STUDENT

This one will save your life. Any maneuver, simulated malfunction or emergency should be discussed prior to introducing it, and briefed prior to practicing it. Once it has been learned, there is no surprise. Imagine pulling the throttle back just after takeoff to see how the student would react without any discussion of engine failure on takeoff. The most expected reaction would be to tense up and pull back on the yoke.

There was an accident in which the instructor had taken a single-engine pilot for his first flight in a twin with the following preflight brief: "Go out and preflight it. Just remember when you get to the engines remember that there are two of them." They both chuckled, and the student went out to perform the preflight. The instructor climbed in and basically started the airplane by himself.

The student then climbed to 4000 feet and leveled out at cruise airspeed. The instructor then pulled the mixture saying "this is how it feels to lose an engine. He coached the student through his idea of the engine failure procedures. "Everything full forward, dead foot - dead engine, pull the throttle, prop and mixture." He demonstrated feathering the engine and restarting. So far there were only a few technical errors on the instructor's part.

After the engine was restarted, he asked the student to slow to 75 MPH. Stall speed was 78 and Vmc was 80. At about 76 indicated, the instructor pulled the mixture on the left engine. What would you expect? The student did as he had been taught. Everything full forward (except the yoke), dead foot - dead engine, pull the throttle, prop and mixture controls full back. He simultaneously feathered the left engine and stalled the airplane. With full power on the right engine and not enough rudder available, the student - and the instructor - were unnecessarily surprised. They spun to the ground. The student was killed, and the instructor permanently paralyzed. Miraculously, there was a friend in the back seat who recovered completely.

People often ask instructors how they manage to stay calm while giving instruction. The secret is that we have learned to sweat out the right side of our face. The real reason I can remain calm is that I plan on avoiding surprises. Before a student gets the controls for the first time I explain and demonstrate what to expect.

Some maneuvers can offer surprises for the instructor. Once, while checking out a new instructor, I asked for an Accelerated Maneuvering Stall. He said "I do these a little differently than most people." That should have told me something, but I was curious about what could be so different. I told him to go ahead. Even though we were in a utility category airplane, he did a snap roll.

When giving stage checks to students, one of the scariest maneuvers for me is the Soft Field Takeoff. When performed incorrectly, the airplane staggers up to about thirty-feet at the slowest possible speed. There is an anxious period where if the engine were to quit, we would fall. Rather than be surprised, I carefully discuss what I will be looking for, and describe the dangers involved. If we get higher than I want to fall, I will take over. As I do, I will point out what I saw.

It is important not to surprise either the student or yourself while operating near the edges of the performance envelope. This is most evident in the emergency procedures phase of multi-engine instruction.

I heard a story about a B-25 instructor during WWII who gave the first simulated engine failure to his student just after takeoff. The student was surprised by the amount of rudder required and didn't have enough muscle to hold the big bomber straight.

> Std: "Help me hold it sir!"
>
> Inst: (with a self satisfied smile) "I can't, I'm dead. Do what you would do in combat."
>
> Std: "Hey Sarge! Help me throw this dead SOB out of here and come up and help me hold this thing!"

If you present students with situations requiring immediate response, without instruction in what that response should be, you may be surprised at what they decide to do.

WHEN TO TAKE OVER

New instructors often ask "How far should I let the student go? There is a dangerous philosophy that suggests that as you gain experience, your limits will increase. Let me suggest that there are three sets of limits as shown below; Ultimate, Personal and Perceptual.

ULTIMATE ----------ULTIMATE

PERSONAL ---------- PERSONAL

PERCEPTUAL ----- PERCEPTUAL

At the outside are the Ultimate Limits. If you exceed these, you will damage the airplane. It does not matter if you are the greatest test pilot in all of aviation, you will damage the airplane. The next level are your own Personal Limits. You are fairly certain of your ability to recover here. Well inside your Personal Limits are the Perceptual Llimits. At this point you have perceived a deviation, and can point out the cues to your student. If the student continues to deviate after you point out the cues, then the proper perception has not occurred. Take over the controls, clarify your description of the cues and the procedure, and reset the situation for another trial.

There is time to do this during normal approaches even into the round-out. The instructor can see that the pitch has changed, point out that less dirt is visible over the nose, and mention that an airspeed change will occur, all before the airspeed actually changes. Then you can say, "Add power and lower your nose." Any hesitancy on the student's part will cue you to take over the controls before your personal limits are reached. With the exception of very dynamic maneuvers, such as tail-wheel landings, you never have to reach your personal limits.

SUMMARY

Throughout four years of college and two years of graduate school ending with a Masters degree in education, and over 25 years of teaching flying, most of what I have learned about teaching can be categorized under one of these insights. The first concept is the most important. Once you understand "behavioral objectives" the rest fit neatly into place. For example, if you

1) STATE A BEHAVIORAL OBJECTIVE, then you must get the student to "want" to achieve that objective.

2) REMIND THE STUDENTS OF THEIR OWN MOTIVATIONS. To help the student see how the objective relates to his motivations.

3) CONTRIVE EXPERIENCE to focus on real world analogies. In order to determine if your objective has been met you must

4) SEEK AND GIVE FEEDBAC K. You must give feedback based on your own cues.

5) VERBALIZE THE CUES THAT *YOU* USE. Because the struggle is between the student and the expected behavior, you may

6) CRITIQUE THE PERFORMANCE AND NOT THE STUDENT.

And finally for emphasis, 7) DON'T SURPRISE THE STUDENT. This last concept helps keep our priorities straight, both in planning and conducting a lesson. No student should ever be asked to perform something that could be dangerous without careful introduction and guided practice. Remember, this one could save your life.