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STUDENT APPROACHES TO LEARNING IN AVIATION CONTEXTS

Mary Niemczyk

ABSTRACT

Self-regulated learning is an important element of student performance and has been found to be linked with content domains. Aviation courses are complex yet serve as the foundation for student success in the flight environment. Since it is critical that students master the content, it is important to determine how students approach learning in these courses. Participants in this study completed a survey consisting of course-related selected-response questions, and open-ended questions focusing on their study habits. Results of the study portray an interesting insight into the learning strategies used by collegiate aviation students. Analyses appear to indicate that learning techniques may need to be improved to promote more successful learning in these types of courses.

Improving Learning in Aviation Contexts

Students entering collegiate aviation programs with the dream of becoming an airline pilot face unique educational challenges. Learning to operate sophisticated modern aircraft equipped with advanced technologies in the flight environment places intense academic requirements on students. The thrill of flight alone does not necessarily carry students through difficult scientific and technical content.

Traditional aviation curricula are comprised of both classroom and flight components. Before students can perform effectively in the flight environment, it is imperative that they have a thorough understanding of the various aspects of flight. In general, the classroom component is designed to provide students with the principles underlying the application of technical knowledge as well as information regarding meteorology, physics, governmental regulations, air traffic control and operations within the national airspace. Because of the depth and complexity of the subject matter, students need to use learning and comprehension monitoring strategies that will enable them to become cognitively engaged. They need to invest effort to make connections, elaborate, translate, organize and reorganize in order to think and process deeply. For many, the subject matter covered is unfamiliar, and unlike any topics they may have encountered during their high-school years. The classroom component, however, plays a critical role in providing the student with

a strong foundation of knowledge. To be effective, aviation academic programs must ensure that the educational process involves an in-depth, effective transfer of knowledge across a broad spectrum of aviation subjects (Karp, Turney, Green, Sitler, Bishop, & Niemczyk, 2002).

As in most collegiate classrooms, aviation classrooms consist of a variety of learners - some struggling, some strategic and some exhibiting characteristics of either from time to time. Students that struggle have difficulty learning and remembering; much that they encounter is perplexing and frustrating. If they do not perform successfully on a task, they may experience feelings of defeat, discouragement, and even apathy. On the other hand, students that are strategic seem to learn rapidly and with apparent ease. They approach instructional tasks with a high degree of confidence that they can accomplish the task. They understand that learning is an active process and they must take responsibility for doing it. Strategic learners are actively engaged with the material, and have some awareness of when they are learning it, and maybe more importantly, when they are not. They look at learning as a process they control (Eggen & Kauchak, 1999; Weinstein & Hume, 1998).

In general, most educational activities are teacher-directed with students attempting to carry out the instructional activity using the learning strategies they know. Unfortunately, many students have a limited set of

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learning strategies that they use for all educational tasks. Many students have not had formal instruction in using various learning strategies. Research has indicated that the learning strategies that students use may be developed through personal trial and error in studying for quizzes and tests (Pintrich & DeGroot, 1990). The effectiveness of the strategy is usually determined by the outcome of the test. If the student did as well as they wanted on the test, the strategy is considered effective. If the student didn't do as well as expected, they may not blame the strategy because it is the only way they know how to study, but instead may become frustrated and just give up.

Self-regulation

Over time, researchers have come to attribute individual differences in learning to students' lack of self-regulation (Zimmerman, 1989). This perspective focuses on what students needed to know about themselves in order to manage their efforts to learn. Although instructors also need to know a student's strengths and limitations in learning, their goal should be to empower their students to become self-aware of these differences. If a student fails to understand some aspect of a lesson in class, he or she must possess the self-awareness and even strategic knowledge to take corrective action. Even if it were possible for instructors to accommodate every student's limitation at any point during the course, their assistance could undermine the most important aspect of this learning – a student's development of a capability to self-regulate (Zimmerman, 2002).

Social learning theorists and cognitive psychologists have stated that in order to be effective learners, students must be actively engaged in their learning (Zimmerman, 1989). Students must not only learn to regulate their own behaviors, but they must also regulate their own cognitive processes. Self-regulation is not a mental ability or an academic performance skill but a self-directive process learners use to transform their mental abilities into academic skills. Learning is viewed as an activity that students do for themselves in a proactive way rather than as a covert event that happens to them in reaction to teaching. Self-regulated learners personally initiate and direct their own efforts to acquire knowledge and skills instead of relying on teachers, parents or others (Zimmerman, 2000).

Self-regulated learning includes the application of learning strategies appropriate for the learning task as well as self-monitoring. In basic terms, a learning strategy is any behavior, thought, or action that a person uses to influence the learning of new knowledge and skills. They are the cognitive tools students use to learn. Using learning

strategies involves the intentional manipulation of information by the learner through processes such as repetition, elaboration, or reorganization of the material in such a way that the new information is able to be stored in the learner's associative network and accessed for retrieval (Weinstein & Meyer, 1991). Knowing about and using learning strategies is a major factor for discriminating between low achieving students and those who experience success (Alexander & Judy, 1988; Pintrich & DeGroot, 1990). Previous research has found that cognitive strategies can be modified through instruction (Weinstein, 1978). Although many students develop their own strategies, further development is dependent on students' exposure to effective models of the use of specific strategies and to environments that provide opportunities for practice (Pintrich, Brown & Weinstein, 1994).

Self-monitoring is another key component of self-regulated learners. Through self-monitoring, learners track their progress toward their goals and change their learning strategies or modify their goals if necessary. Self-monitoring includes comprehension monitoring where students check to make sure they understand what they are reading or hearing (Ormrod, 2000; Weinstein, 1998).

Students who regulate their learning and monitoring experience greater success in moving toward their goals. This in turn enhances their self-satisfaction and motivation to continue to improve their methods of learning. Because of their high motivation and adaptive learning methods, self-regulated students are likely to succeed academically (Zimmerman, 2002).

Much of the previous research on self-regulated learning has indicated that self-regulatory processes are linked with content domains, and individuals learn how to apply these skills in a given learning or applied context (Kiewra, 2002; Zimmerman, 1998). Determining specific self-regulatory processes associated with successful learning in particular content domains is an important next step in this line of research.

The purpose of this study was to determine students' reports about their most preferred and utilized study techniques and the techniques they used to monitor their learning in aviation courses. This investigation represents the first in a series of studies focusing on improving learning in aviation courses.

METHOD

Subjects

All participants in this study were students in an aviation degree program at a university in the southwest. There were 108 participants; 28 were enrolled in an Air Traffic Control course, 45 were enrolled in an Aviation

Policy course, and 35 were enrolled in an Aviation Law course. All three courses were requirements of the degree programs. Of the 108 participants, 89 were male and 19 were female. Seventeen percent were sophomores, 31% juniors, and 52% seniors. Students ranged in age from 19 years to 31 years, with an overall average age of 22.

Procedures

Each of the courses consisted of a lecture-type delivery taught by the same instructor. The courses met twice a week for 75 minutes each class session. Data were collected at the end of the fall semester during class. Participation in the study was voluntary.

Materials

The survey consisted of two sections. The first section included demographic questions as well as two selected-response questions regarding the lowest grade participants would be happy with in the course, and how many hours a week they study for the course. The second section consisted of eight questions, two selected-response and six open-ended, focusing on student study habits. The selected-response questions asked participants if they study differently for this course than for their other courses and who is responsible for their success in learning, themselves or their instructor. The open-ended questions asked participants to describe two ways that they study for this course, two ways that they study for their other courses, how they check their understanding of the material while studying for this course, what is their

major strength as a learner, what is their major weakness as a learner, and what they think would help them become better learners. Questions were based on a similar study investigating students' reports about their most preferred and utilized study techniques and the techniques they used to monitor their learning in a Computer Literacy course (Niemczyk & Savenye, 2005).

Data Analysis

Responses to the selected-response questions were compiled and summarized by frequency of occurrence. The responses to each open-ended question were analyzed and categorized by discernable themes. The number of responses in each thematic category was then calculated.

Results

Responses to General Course Questions

Participants were asked to respond to two selected-response questions regarding the lowest grade they would be happy with, and how many hours a week they study for the course.

Lowest Grade Acceptable. Participants were asked to indicate the lowest course grade that would be acceptable to them, A, B, C, D, or E. For each participant, the actual grade earned was then compared to the lowest grade acceptable. Summary of the responses and the comparison between the lowest grade acceptable and actual grade earned are provided in Table 1.

Table 1
Comparison of Lowest Grade Acceptable to Actual Grade Earned

Lowest grade acceptable	Participants indicating this as lowest grade acceptable	Actual grade earned by participants				
		A	B	C	D	E
A	58 (54%)	0	19 (33%)	35 (60%)	4 (7%)	--
B	41 (38%)	0	7 (17%)	23 (56%)	11 (27%)	--
C	9 (18%)	0	0	3 (33%)	5 (56%)	1 (11%)

N = 108.

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All participants wanted to earn a grade higher than C. In total, 10 students, or 9%, earned the grade they indicated would be the lowest grade acceptable, 98 students, or 91%, earned a grade lower than that which was acceptable, and none of the students earned a grade higher than their lowest grade acceptable.

The range of final course grades was from B through E. Final course grades resulted in the following distribution: A = 0, B = 26 (24%), C = 61 (56%), D = 20

(19%), and E = 1 (1%).

Number of weekly study hours. Participants were also asked how many hours a week they study for the course. They were given five possible choices to select from; 0 hours, 1-3 hours, 4-6 hours, 7-8 hours, and more than 9 hours. Response totals and percentages are provided in Table 2.

Table 2

Reported Number of Study Hours per Week Dedicated to the Aviation Course

Hours per week	Total responses
0	4 (4%)
1 - 3	80 (74%)
4 - 6	18(17%)
7 - 8	6(5%)
9 or more	0 (0%)

N = 108.

In general, 80 students, or 74%, indicated that they dedicated between one to three hours per week studying for the course and 18 students, or 17%, indicated that they dedicated four to six hours per week studying for the course. Six students, or 6%, indicated they studied seven to eight hours each week for the course, and four students, or 4%, responded that they did not study at all for the course.

Responses to Questions About Students' Study Habits

Students were also asked to respond to two selected-response questions and six open-ended questions focusing on their study habits. Their responses were analyzed by frequency of occurrence. Not all participants answered all of the questions in this section, possibly due to time constraints or simply lack of interest in responding. Because of this, the total number of responses for each question may not equal the total number of participants. Summaries of the responses for the selected response questions are provided in Table 3 and the open-ended question responses are provided in Table 4. The responses for each question are listed in rank order of occurrence, beginning with the highest-ranking response. The numbers provided indicate the total responses. The percentages are

based on the total number of responses for the particular question. Results of the analyses on the two-selected response questions will be presented first, and will be followed by the results of the analyses on the six open-ended questions.

Selected-response Question Results. The first selected-response question asked students if they studied differently for this particular aviation course than for their other courses. Students were to respond by circling either "Yes" or "No". Of the 108 participants responding to this question, seven, or 6%, circled "Yes", indicating that they studied differently, and 101, or 94% circled "No", indicating that they studied the same way.

The second question asked students who they thought has responsibility for their success in learning. Students were to respond by circling "I am", "My instructor is" or "Both". Of the 112 students who responded, 32, or 31%, circled "I am" indicating that they are responsible. A small group of students, two or 2%, circled "My instructor" indicating that they feel the instructor is responsible for their success in learning, and 78, or 77%, circled "Both" indicating that both they and the instructor are responsible

for their success in learning.

Table 3
Summary of Responses to Selected-Response Study Habit Questions

Questions and Responses	Air Traffic Control	Aviation Policy	Aviation Law
Do you study differently for this class than most of your other classes?			
Yes	2 (29%)	1 (14%)	4 (57%)
No	26 (26%)	45 (44%)	30 (30%)
As a student, who do you think is responsible for your success in learning?			
I am	7 (22%)	11 (34%)	14 (44%)
My instructor	1 (50%)	1 (50%)	--
Both	20 (26%)	36 (46%)	22 (28%)

Open-ended Question Results. The first open-ended item in this section asked students to list two ways that they studied for the particular aviation course in which they were currently taking the survey. Reading the text and notes was the most frequently-listed study technique, with 71 responses or 60%, followed by memorizing the material, with 13 responses, or 11%. Studying with peers was listed 13 times, or 11%. Ten students, or 9%, stated that they developed their own study guides, and nine students, or 8% outlined the readings.

The second open-ended question asked students to list two ways that they studied for their other courses. Again, the most frequently-listed study technique indicated by students was reading the text and notes, with 70 responses, or 74%. The next two most frequently occurring responses were studying with peers and outlining readings. Each was listed eight times, or 8%.

The third open-ended question asked students to describe how they check their understanding of the aviation course material. Twenty-six students, or 43%, indicated that they quizzed themselves, and 18, or 30%, indicated that they studied with peers. Sixteen students, or 27%, listed memorizing and reciting information back as their method for checking understanding.

The fourth open-ended question asked students what they considered to be their strength as a learner. In

total, 47 students responded. Twenty-nine participants, or 62%, indicated their ability to memorize was their strength, 15 students, or 32%, stated that their strength was based on the fact that they were motivated, and three students, or 6%, cited their ability to comprehend and understand.

The fifth open-question asked students what they considered to be their weakness as a learner. Most responses centered around two main themes, lack of focus and poor memory. Of the 61 students who responded to this question, 36 students, or 41%, indicated that lack of focus and concentration was their weakness, and 20, or 33% of students indicated that their weakness was due to their poor memory. Thirteen students, or 21%, indicated that they didn't have enough time to dedicate toward studying and three students, or 5%, indicated that they lacked knowledge of appropriate learning strategies.

The final open-ended question asked participants what they thought would help them to become a better learner. From the responses, it appears that there are four factors students felt could possibly influence their learning. Of the 62 students that responded, 30, or 48%, indicated they needed more discipline, and 15 indicated that they needed better time management. Twelve students, or 20%, stated that they needed improved focus and concentration, and five students, or 8%, needed a better memory.

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Table 4
 Summary of Responses to Open-Ended Study Habit Questions

Questions and Responses	Air Traffic Control	Aviation Policy	Aviation Law
What methods do you use to study for this course?			
Read text and other course materials	26	27	18
Memorize material	--	5	9
Study with peers	4	3	6
Develop own study guide	--	6	4
Outline/highlight course materials	2	7	--
What methods do you use to study for your other courses?			
Read text and other course materials	24	19	27
Memorize material	--	3	7
Study with peers	5	--	3
Outline/highlight course materials	--	6	2
How do you check your understanding of course material?			
Quiz myself	15	7	4
Study with peers	5	5	8
Memorize and recite information back	2	10	4
What is your major strength as a learner?			
Ability to memorize	8	12	9
Motivation	4	6	5
Ability to comprehend and understand	3	--	--
What is your major weakness as a learner?			
Lack of focus and concentration	6	10	9
Poor memory	3	10	7
Lack of time	4	6	3
Lack of appropriate study strategies	--	3	--
What would help you to become a better learner?			
Discipline	14	16	--
Improved time management	--	1	14
Improved focus and concentration	4	4	4
Better memory	--	2	3

Note: Total number of responses varies between questions because some participants did not provide responses while others provided multiple responses.

DISCUSSION

The purpose of this study was to determine students' reports about their most preferred and utilized study techniques and the methods they used to monitor their learning in aviation courses. Also investigated were the student's grade goals and the amount of time each week spent studying for the course.

The results of this study provide an interesting insight into the learning and comprehension strategies utilized by college students in aviation courses. Overall, the results appear to indicate that these students utilize the same study techniques for both their aviation and non-aviation courses. Students checked their understanding of course materials by self-testing, studying with peers, or testing recall of information just memorized. The learning strengths listed were good memory and motivation; weaknesses were lack of focus and concentration, poor memory, and lack of time. For many students, earning a high grade was important to them, however, only 10 students earned the grade that they indicated was the lowest grade acceptable to them. The remaining students earned a poorer grade than the lowest grade acceptable to them. The majority of students reported that they spent between one and three hours per week studying for this course, however, many indicated that more discipline and a study schedule would help them become better learners.

Student reports indicate that they are utilizing the same study strategies for their aviation and non-aviation courses. Results from previous research have indicated that use of various learning strategies may be conditional and contextualized. For some courses, deep processing strategies like elaboration are better, but for other courses, and certain types of exams, rehearsal strategies may be more effective, or at least are correlated highly with students' performance on the exam. Students, therefore, need to understand the situations when certain learning strategies may be more or less effective. The key is to match the strategy with the learner's task, and context (Kiewra, 2002; Pintrich & Garcia, 1994). When encountering a learning situation for the first time, students may not know how to think within that discipline. Pintrich (1995) suggests that in order for students to become successful self-regulated learners, instructors should help students become aware of how to think, learn, and reason within the particular discipline.

Most students do not often give consideration to how they learn new things, however, they need to become aware of the many and different ways that they can process information. They must learn how to evaluate the effectiveness of different strategies for different learning situations. The specific learning strategies students use when

attempting to learn new information affects their ability to use and remember that information later. Teaching students about learning strategies helps them to become aware of how they process new information, improve the strategies that they use, learn new strategies, and develop systematic ways to approach studying and learning (Weinstein, 1998).

Strategy instruction is seldom incorporated into most curricula, however. Most often, educators focus on teaching content and rarely instruct students how to specifically learn the content (Kiewra, 2002). Many instructors were, perhaps, good students who learned easily. Consciously, or unconsciously, they picked up the "tricks of the trade", the techniques that learners use to handle and retain greater amounts of information or pass examinations. Instructors may tend to believe, therefore, that students know these same techniques or will easily adapt to what is required. Educators need to assist students to understand how to learn specific content material and to employ a wide range of learning strategies (Cates, 1991). Promoting the use of good strategies can be done very effectively during the course of normal classroom instruction. In very basic terms, instructors can provide note-taking frameworks, or provide students with matrices to aid organization and build relationships between new and past knowledge (Kiewra, 2002). In this study, only 10 students earned the grade that they indicated was the lowest grade acceptable to them, with the remaining 98 students earning a poorer grade. This, perhaps, may be an indication that students are not using strategies appropriate for the learning tasks.

Many of the students in this study indicated that they memorized information and monitored their learning by being able to recite the information just memorized. While memorization may be a useful learning strategy in some situations, students need to become aware of the many and varied ways they can process information. They need to learn how to evaluate the effectiveness of different strategies for different learning tasks (Weinstein & Hume, 1998; Weinstein, 1998). Other types of strategies, such as elaboration or organizational, may be more useful in some of these learning situations.

Students may also need to improve their comprehension monitoring techniques in order to effectively evaluate their progress in learning. Comprehension monitoring includes having knowledge about one's own learning strengths and weaknesses, knowledge about the nature and desired outcome of the learning task, and knowledge of strategies that can be used to assist learning or that can be utilized when a comprehension problem is encountered (Weinstein & Hume, 1998). Strategic learners know how to balance effectiveness and efficiency in using

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strategies to meet their learning goals (Weinstein, 1998).

Interestingly, many students indicated they felt responsible for their success in learning, however, only 10 of them earned the grade that was the lowest acceptable, with the remaining students earning a poorer grade. Students also indicated they believed they could be more successful if they had a study schedule and more discipline. It may be beneficial, therefore, to not only provide students with appropriate strategies for learning course material but to also assist them in establishing suitable study schedules.

The results of this study highlight the learning and comprehension monitoring strategies used by college students in aviation courses. This study not only provides information on students' use of self-regulated learning strategies, but it also gives insight into how undergraduate students view learning and the methodologies they use to

study. The information provided from this study may assist instructors of aviation students, as well as other technologically- based courses.

As stated previously, this investigation serves as the foundation for a series of other studies focusing on improving student learning in aviation courses. These results support a larger multi-faceted project that will incorporate the development of a "toolbox" of strategies to be utilized by instructors and students. Among other resources, the toolbox will include the development of a meta-curriculum incorporating various motivation, learning and comprehension monitoring strategies found to be useful in enhancing student learning, as well as tactics for improving recruitment and retention of all students. →

Mary Niemczyk is an Assistant Professor in the Aeronautical Management Technology department at Arizona State University. She earned her doctoral degree in Learning & Instructional Technology at Arizona State University. Mary's educational and professional experience consists of work in both the aviation and education environments. Her aviation experience includes her work as a financial manager at a major US airline, and co-founder of an aviation human performance research company that focused on issues concerning pilot training and human factors in working with the automated cockpit. Mary has also been active in the educational technology arena where she has conducted several research studies focusing on self-regulation of student learning and motivation, and teaching and learning in computer-based environments. She developed a course for teachers interested in teaching their students appropriate learning strategies as well as a metacurriculum used by collegiate aviation instructors to improve learning and motivation in their courses. Mary has presented her work at both aviation and education conferences and has published her work in both aviation and education books and journals. She is the faculty sponsor of the student Women in Aviation International group at ASU and an FAA certified pilot.

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