2020

Learning Theory and Differentiation in Flight Instruction: Perceptions from Certified Flight Instructors

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Aviation is a trillion-dollar industry with a critical shortage of commercial pilots (Garcia, 2018; Statista, 2018). Canadian Aviation Electronics (CAE) (2016) forecasts the need for a 60% increase in new pilots worldwide by 2027 to accommodate industry growth and another 40% to offset retirement and attrition. To compound the problem, approximately 80% of student pilots drop out of flight training programs every year (Beckett, 2016). One strategy to minimize the loss of potentially skilled pilots is to focus attention on providing flight instructors with the background knowledge to understand student learning and better support student pilots as they progress through flight training programs.

Current Study

Flight instructors with a better understanding of MI Theory and its applications to instruction can employ these strategies for better design and style of instructional delivery for effective learning. Multiple intelligences concepts provide a method for greater understanding of learning, with respect to how learning styles and teaching styles can merge to shape learning potential. For this study we focus on one area that may improve flight training: educating flight instructors about MI Theory. The decision to conduct this study emerged from selective discussions with new flight instructors about their students' difficulties in understanding and applying knowledge and skills presented by their instructors. In these discussions, it was often discovered that the instructor had no knowledge regarding how a student might learn most effectively. The participating instructors noted that they read a very short summary of learning theories in their flight instructor training; however, they were neither provided examples of learning theories nor received training with respect to application of learning theories. Therefore, this study is intended to determine if extended knowledge of Multiple Intelligences (MI) Theory would reflect a perceived greater comprehension and skill mastery by students and

instructors. This study focuses on the perceptions of flight instructors and use of MI, teaching performance, and understanding the reduction of instructional barriers.

Literature Review

Aviation Instructor's Handbook. Aviation continues to be a rapidly changing and increasingly more complex industry (CAE, 2016), yet aviation education and training processes have changed very little over time. The Federal Aviation Administration (FAA) updated the 1977 and 1999 versions of the *Aviation Instructor's Handbook* (FAA, 2008) nearly 10 years ago, in 2008. Although the 2008 version of the *Aviation Instructor's Handbook* provides valuable information, it is limited in scope regarding the presentation of learning theories, learning styles, scenario-based training, and evidence-based practical instruction pedagogy. The learning styles section of the *Aviation Instructor's Handbook* is a total of four pages (FAA, 2008). It is possible flight instructors could be more informed about additional learning theories; for example, the use of Universal Design for Learning and the tailoring of instruction to student learning needs through understanding of theories like Multiple Intelligences and learning styles.

Learning styles. Learning styles refer to the optimal characteristics for individual students learning; this includes the setting, environment, and instructional methodology (Strawser & Kaufmann, 2020). The topic of learning and learning styles has been the subject of research for decades (see Gardner, 2011). Within aviation, Kanske and Brewster (2001) conducted research regarding the learning styles of collegiate aviation students and Air Force pilots. The authors found that most of the pilots tended to lean toward the assimilator or convergent learning styles on the Kolb learning style inventory. However, there is still insufficient agreement on how effective learning occurs for individual students, and aviation research is limited in this regard. The literature indicates that many instructors continue to be

challenged with finding a way to respond to individual learning styles (Wofford, Ellinger, & Watkins, 2013).

Multiple Intelligences (MI) Theory. Gardner (1983, 2011) developed and refined one learning theory, termed MI Theory, to explain the capabilities of individuals that were not historically captured by traditional intelligence tests. Although his research appears to be largely ignored by psychologists, it continues to be of interest to professional educators and other education stakeholders. MI Theory is comprised of eight categories: (a) bodily-kinesthetic, (b) interpersonal, (c) intrapersonal, (d) linguistic, (e) logical-mathematical, (f) musical, (g) naturalistic, and (h) spatial (Gardner, 2011). Gardner constructed MI Theory to describe the existence of several intelligences inherent in individuals but could also be further developed with guidance (see Gardner, 2011). Each of the intelligences possesses certain characteristics that lend themselves to particular skills; educators need to modify their instructional methods to satisfy the needs of the different type of intelligences (Gardner, 2011).

In terms of flight instruction, flight instructors would have to modify their approach to instruction to satisfy each student's intelligence in a similar fashion. Without the introduction of knowledge regarding MI Theory and associated learning styles, flight instructors may be challenged to identify ways to respond to individual learning needs and styles. Overchuk and Niemczyk (2009) conducted a study of 86 pilots and found that pilots were typically identified in the areas of intrapersonal and spatial intelligence, leading to a discussion on the need to instruct based on the needs of learners with those learning styles. Introduction of additional learning theories, such as MI, does not disrupt standardized training. The FAA regulates what is taught and standards of performance, but it does not regulate *how* to the topic is taught.

Criticisms of MI Theory. Some note that Gardner's theory appears to be derived more from his own intuition and reasoning than from empirical research (Armstrong, 2018). As such, Multiple Intelligences Theory is not without criticism from researchers and scholars. There are three central criticisms: (a) there is a lack of research pertaining to the definitive answer as to whether or not Multiple Intelligences exist, (b) there is a lack of research pertaining to the efficacy of using Multiple Intelligences concepts in academic settings, and (c) the belief that Multiple Intelligences Theory is a strategy for "dumbing down" curriculum, because students will be categorized into specific groups based on assumptions about their ability to learn or not learn in specific subject areas (Armstrong, 2018). Thus, it is the objective of the authors to present more evidence to better understand MI theory in the aviation environment.

Method

This study utilized a qualitative research design in the form of case studies. The first author developed analytic statements based on participant journals, observations, and interviews. The researchers sought to analyze flight instructors' perceptions regarding whether knowledge of MI Theory improved their teaching effectiveness. The data was triangulated using open, semi-structured interviews, as well as flight student and flight instructors' observations (with field notes) in a simulator, and from the flight instructors' notes on lessons and training methods. Triangulation of data included multiple viewpoints and perspectives, allowing for greater accuracy and reliability of data interpretation (Yin, 2009).

Setting and Participants

The first author secured approval from the University's Institutional Review Board (IRB) and participants were chosen for this study by a purposeful sampling design. They were selected due to their assignment to teach students in a simulator course in a collegiate flight program.

The participants were eight part-time CFIs (n = 8) who taught 22 full-time students at the university. The flight students were in their second year of flight coursework, had their private pilot certificate, and were training for an instrument rating. The demographics of the CFIs included experience ranging from less than one year to more than five years. All participants were 18 years or older (M = 22.85, SD = 2.09); participants consisted of one female and seven male flight instructors.

Data Collection, Analysis, and Procedure

Four types of data were collected during this study: direct observations, instructor journals, Multiple Intelligences Survey responses, and interviews. Regarding the survey, a questionnaire developed by McClellan and Conti (2008) was used to determine the optimal intelligence styles and corresponding strengths of their students to support instructors' positive perceptions of their students. McClellan and Conti (2008) conducted a factor analysis to confirm the construct validity of the MIS.   Accordingly, data reduction procedures resulted in the MIS being decreased from its 45-item, field-testing version to a 27-item preference indicator and was found sufficiently reliable. Observations and interview responses were coded after each data collection session and analyzed using NVivo10 (2015). The CFIs participated in an eight-hour training that introduced MI Theory. Participants were provided strategies for developing flight lessons that were best tailored to individual student learning styles. They were provided with information regarding MI Theory, including definitions of the different types of intelligence and examples of student behavior linked to the different types of intelligence. Further, the participants were given a list of the intelligences and how they could potentially provide different pathways to adult learning.

Results and Discussion

Direct observations were used to document student and instructor interactions, attitudes, and behaviors during students' flight simulator lessons. The researcher recorded his observations during lessons to capture information as it occurred. The instructor journals provided a stable, unobtrusive, and accurate form of data collection that contained information solely from the perspective of the participating instructors. Instructor journals were used to corroborate other forms of data and to obtain data in the words and language of the individual participants. The total number of observations, surveys, and journal records totaled eight (n = 8). Each participant was interviewed at the end of the study. The researcher utilized a semi-structured interview process (Creswell, 2007). Each interview lasted for approximately 40 minutes. The interview questions developed by Berkemeier (2002) were used as a guide in the development of interview questions used in this study. The direct observation data, instructor journals, and interview transcripts were entered into NVivo 10 to examine their commonalities. The interrelationships and patterns found in the data guided the data analyses (Stuckey, 2015). Selective computer coding was used to aggregate the data into appropriate categories for analysis. For example, participants' similar responses to interview questions were clustered into categories. Observations and interview responses were categorized by feelings, opinions, and perspectives as they occurred, allowing the researcher to examine issues as the study progressed. For the purpose of this study, direct quotes from interviews and journals are incorporated to highlight participant responses to questions.

The following perceptions emerged from the triangulation process: (a) MI Theory training was helpful to understand students' learning styles, (b) flight instructors would use their knowledge of MI Theory in the future, (c) instructors perceived themselves as better at their job

after MI Theory training, and (d) CFI training lacked sufficient information regarding individual student differences and differentiation of instruction.

MI Theory Training was Helpful to Understand Students' Learning Styles

The participants' perceptions about the information obtained, regarding MI Theory, provided them with a structure to evaluate learning styles. They reported that MI Theory-related information helped them, "hone in on students' learning abilities, and helped them out in [knowing] where the students' strengths were; in another sense helped determine their weakness." They also mentioned that the awareness of MI Theory traits made it "obvious, everyone learns differently." One participant stated, "If you cater to their learning styles, per say, I think they will get more out of it."

The participants noted that MI theory improved their instruction. They expressed the importance of ensuring flight lessons were designed to match students' individual learning styles. They noted that understanding the learning challenges of each student helped them to develop lessons that provided an increase in positive learning climates and experiences. They indicated that their enhanced understanding of MI Theory made them aware of, and more sensitive to, each student's learning style and the realization that flight instructors were often teaching to their own personal learning style, and not to those of their students. They also revealed that knowledge of MI Theory made them better flight instructors.

Flight Instructors Would Use Their Knowledge of MI Theory in the Future

The participants indicated that information regarding how to determine a student's learning style and how to modify a lesson to utilize students' abilities would be useful in future flight training activities. One participant, when asked if they would use learning style knowledge in future flight instruction said, "I sure would, because it's important to help convey the ideas to

students, because if they have a different method of learning, then of course it's going to help them, or help you to teach them, if you know exactly what they favor." The participants stated that they will use their knowledge of learning styles, particularly multiple intelligences, in their future training of flight students.

They also stated they will use MI Theory-related instructional methods in future flight instruction. The participants believed knowledge of MI Theory allowed them to focus on students' strengths and, equally important, students' learning challenges and needs. Learning about MI Theory helped flight instructors to individualize their lessons for improving students' understanding and confidence levels. They believed that learning about MI Theory helped them to better teach concepts and skills and flight students' comprehension levels were higher. One participant stated that the strategies they used, based on MI Theory, aided in determining if their student was comprehending and applying concepts or skills instead of just memorizing or copying the tasks.

Instructors Perceived Themselves as Better at their Job after MI Theory Training

The instructors indicated that the selection and implementation of appropriate instructional strategies were imperative when providing learning experiences that enhanced students' learning performance and outcomes. One participant stated, "I was always teaching using my learning style because I knew it worked for me, and it was easiest for me to understand. I am more sensitive to it; I can pay more attention to it, especially with a new student." Another participant indicated, "I already used some of the ideas, but I did not realize it. I will continue to use these methods to help people out." One participant also stated, "I have become more creative, I think overall it will help students, especially if you can cater to their learning style." All eight participants indicated that MI Theory training made them a better instructor.

The results indicated that the participants agreed that the information provided to them enhanced their flight training. When asked if the information provided to them about MI Theory and methods would be useful to them during future flight instruction, they all stated yes, they would use their knowledge of MI Theory in future flight training. One participant said that he would use his knowledge of MI Theory to help identify his students' strengths and challenges and to build their confidence levels. Another stated that learning about MI Theory made him realize that everyone learns differently, and it caused him to become more sensitive to each of his student's abilities. An additional participant subsequently used their knowledge of MI Theory to enhance their own methods of learning. The instructors and their students developed a variety of learning aids, based on their learning styles, and used the strategies that they believed would be most effective for them to learn, retain, and apply skills. They believed that knowledge of MI Theory had helped them develop their ability to perceive a student's most effective learning styles by watching how they processed information provided by the instructor. The participant stated that, in the future, he would present information centered on his observations and refine his approach for providing information based on each student's performance.

CFI Training Lacked Sufficient Information Regarding Individual Student Differences and Differentiation of Instruction

The participants stated that the FAA training materials provided beneficial technical information on the skills required for flight training. They also reported that the FAA clearly described the standards needed to complete the required training and to obtain a pilot certificate. However, all but one participant felt that they had not been given strategies to effectively teach the FAA's required content to their flight students. They also believed that they had not been taught about using a variety of instructional methods. One instructor commented, "Not every

student is the same, so you're going to have to find different techniques to teach them. They just state 'Do it', but they didn't tell you how." Another was a little more direct in stating, "I'd say no, it probably didn't adequately prepare me for each person learning in different ways, nor did it even teach me how to identify that." While one simply stated, "They pretty much showed me how to make a lesson plan and then said you will learn how to do it when you get some students."

Most of the participants indicated that flight instructors were not taught how to modify lessons to accommodate student learning differences, particularly based on student strengths and challenges. Some participants indicated that they were told that students learn at different levels and learning styles; however, they did not receive training on how to modify lessons to fit those learning styles. One instructor stated that they were not adequately prepared to adapt teaching strategies for individual students' learning traits or how to identify students' learning differences. Another participant was simply taught to develop lesson plans and present them, which would be sufficient for their CFI training, while yet another participant was told to learn how to teach students on their own and to develop better methods over time. The one participant who had divergent responses on this theme stated that the instructor who provided them with their CFI training did include instruction on individual student learning differences and required them to teach techniques using a variety of strategies.

General Discussion

The objective of this study was to examine flight instructors' perceptions of the influence of learning theory knowledge, particularly MI Theory, may have on flight instruction and flight students' achievements. The need to ensure that flight students are achieving at their highest potential regarding understanding, decision making, and safety, requires the use of effective

instructional strategies that address diverse learning needs. The evidence suggests that participants perceived improved ability to design and implement effective flight lessons tailored to their students' learning styles. We also found that participants believed that they benefited from their understanding of MI Theory and would use MI Theory concepts in future flight instruction. Lastly, we found that participants detected a major gap in their CFI training due to the lack of clear preparation regarding teaching students based on learning styles and differentiation of flight lessons based on those learning styles.

Limitations

The sample used in this study consisted of only flight instructors in two instrument training courses in one collegiate program. Therefore, the sample used in this study likely did not represent all student pilot populations. Furthermore, the flight instructors may have unknowingly contributed to the Pygmalion Effect, while their flight students may have demonstrated gains due to the Hawthorne Effect. An educator's belief about how a student will perform leads to the student performing at that level. This is known as the Pygmalion Effect (Rosenthal & Jacobson, 1968). Further, having an outsider in the educational environment may lead to the Hawthorn Effect, which tends to produce abnormal behavioral responses from participants who are being observed (Mayo, 1933). Observation during flight instruction may affect the types of interactions and behaviors that are demonstrated by instructors and students. The researcher attempted to desensitize the instructors to his presence within training settings by being continuously present before data collection began.

Further Research and Recommendations

This study provided positive outcomes that can be further developed for work with flight instructors. Future research could include inquiry into universal design for learning and other

learning theories to determine best options to support CFI teaching. Research could also consider addressing cultural implications of learning styles and differentiation of instruction. The findings and implications of this study lead to multiple recommendations, particularly regarding policy, practice, and research. Enhanced lessons that focus on individual student's learning strengths may improve those students' subsequent flight knowledge and skill level. Although MI Theory is only one avenue to provide flight instructors with the methods necessary to understand their students' learning styles, the basic theory is relatively easy to understand and illustrate. Future research can be conducted longitudinally to understand behavior and longer-term behavioral changes.

We recommend that provision of multiple examples regarding how a lesson can be presented to students with a variety of methods (i.e., universal design for learning) be taught to flight instructors. This will allow instructors to develop a wider variety of approaches to take advantage of individual student's most effective learning style. If an instructor adapts a lesson to the student's learning style, it may improve the lesson's effectiveness for that student. Moreover, students who are encouraged to enhance self-awareness of personal learning styles have the potential to further develop and use them in the future. This can lead to long-term impact: the ability of students to advocate for effective, individualized learning experiences throughout their professional careers.

Finally, flight instructors must complete a refresher course every two years if they do not obtain an additional certificate or rating. This may be an opportunity for the regulators to include robust learning theory and differentiation content. Another opportunity for dissemination is within future versions of the FAA's *Aviation Instructor's Handbook*.

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