Inadequate Post Simulation Debriefings in Air Traffic Control and Pilot Training

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In safety related domains such as ATC, advanced simulation offers realistic operations in a safe and controlled environment. These sessions are followed by a debriefing period where research has shown that these learning opportunities are greatly underutilized. Debriefings that are constructed with a lecture and learn format are not as effective in creating an environment where students can self-reflect on their performance and what they can take back to normal operations. Despite the willingness of instructors to manage the debriefing in a facilitated manner, there can still be impediments to student learning. These learning barriers, or knowledge shields, have to be overcome if effective facilitation and self-reflection are to be successful. Here we report on successful facilitation techniques and those signs that students arrive ready to learn in a constructive and self-reflected atmosphere.

Keywords – training; debriefing; facilitation; LOFT; simulator

I. INTRODUCTION

Many safety sensitive domains utilize advanced forms of simulation to achieve learning objectives for both initial and recurrent training. An important benefit is that these offer an operationally safe environment for technical exploration and mistakes. Regardless of the training outcome, research has shown that these sessions are more meaningful when followed by a debriefing of the training experience. Simulator sessions allow practitioners a chance to grow skills and practice procedures that are infrequently experienced in the normal operational environment. The development of new skills, reflections and lessons learned are better achieved when debriefings are conducted in a facilitated manner. That is, the student conducts the debriefing of their performance and can self-reflect as to how this experience was meaningful.

Facilitated debriefings are a method where the instructor encourages the pilots to evaluate their own performance of their simulator session. In both poor or excellent performance there are still lessons and potential discussions to help promote lessons learned for real world operations. Currently, because of scant regulatory guidance in addition to a lack of training for professional instructors makes debriefings greatly underutilized educational component.

Despite this limitation, the idea of performing a facilitated debriefing is not new to safety sensitive training domains. For example, in aviation, for many years the FAA has actively encouraged instructors to use facilitation methods to enhance the learning experience by giving students an opportunity to take this self-reflective ability to their normal flying. The end goal is that next time an operational challenge is encountered; they will be able to better understand what happened and how to learn from these events. However, with only some basic provisional research by the FAA and NASA and many within the instructor/training community, more specific guidance on how professional instructors are to effectively conduct facilitated debriefings is absent. Perhaps equally important, what should the instructor do when they encounter barriers to learning? The training community and more specifically some individual instructors have taken it upon themselves to define what this skill means. As expected, there can be significant differences in how this tool is applied or even desired across industries and organizations such as Air Traffic Control (ATC) and the flight deck.

Because of these industry-wide debriefing concerns, our research attempts to better understand both its scope and depth. Specifically how instructors that use some form of facilitation do so and how do they manage barriers to learning they encounter. To do so, our study utilized a core of dedication professional simulator instructors. By using a semi-structured diary study, we captured impediments to learning, and examined potentially successful mitigation strategies.
Our discoveries will help inform professional aviation training facilities to some best practices in addition to recommendations for overcoming barriers to learning while conducting facilitated debriefings. We believe these methods can be applied to any safety sensitive industry that uses debriefing as an educational tool after advanced simulation.

II. ADULT LEARNERS

Educational drivers such as self-betterment motivate adult professional learners and “reflective practice”, as coined by Schon, describes the values, assumptions, and knowledge base that drives one’s own professional practice [1][2][3][4].

Both flight deck and ATC are like other safety sensitive domains, that is, one that demands rigorous training and procedures. Additionally, also needed are flexibility to manage complex events with resilience and the ability to apply learned knowledge in hopefully novel ways for managing future disruptions. Reference [5] discussed that deficiencies in the learning of complex material include the inability to flexibly apply knowledge in new situations. Aviation related training, such as ATC training is probably the most regulated and intense experiences across many safety sensitive domains. As an industry, we need to consider if our current training paradigm is really the most productive use of time spent. Is there a better way we can teach, monitor and evaluate today’s air traffic controllers? It is well established that experiential learning is the most effective method for adults with some research showing a 20 to 25% increase in knowledge attainment. Despite the depth and regulation of modern aviation training, it should not be misconstrued to mean that we are training and checking in the best possible way in both ground school and simulators.

Both ATC and flight deck training are better than they were 20 years ago. However, we still have a significant disconnect within the ground school’s presented material and how testing is performed. Additionally, how this material relates to the simulator experience and testing are other considerations. Reference [9] say “it is necessary to implement systems of testing that are consistent with goals for learning and that, in particular, require for successful performance the kinds of cognitive activities and outcomes valued in the instructional process.” Thus, creating a better representation between the complexities of the required material, methods for teaching it and how we test for knowledge objectives are the crux of how to make our current system better. Nevertheless, a better understanding of how adults learn in various training environments would serve us well to structure how we attempt to learn both simple and complex subjects.

III. METHODOLOGY

Part of any research plan lies the question – what is the best research methodology to pursue your objective? Cognitive Systems Engineering (CSE) is a field of study that examines the intersection of people and their environments. Typically, all or at least most CSE research is conducted in one of three research settings: experimental/spartan laboratory studies, simulation/staged world studies, and in-situ observational techniques [9].

With each of these, there are strengths and weaknesses depending on how we control for both the varieties of observation and discovery/verification. Our study is qualitative in nature as behaviors and learning outcomes are sought. Although the diversity of our subject population is not diverse as typically seen, reference [9] explains that in complex and dynamic systems “must use a different subject population than the typical subject of psychology experiments.” The aim of our research is to better understand how instructors, when using facilitation methods, encounter barriers to learning and 1) recognize the barrier, and 2) how they effectively mitigate its effects. Because these barriers are variable and can impact learning, capturing any of these events as they occur during facilitated debriefing offers the researcher a chance to experience any number of ways that students may be impacted.

A. Task one – Literature Review:

The start of our research was to capture a literature review of both the debriefing literature (in various domains) but also those of adult learning, knowledge shields and NASA’s research base on the subject of facilitation in aviation post-simulator debriefings. This information helped us develop a thorough understanding of both the effective and ineffective facets of post-simulator training debriefings that have been researched thus far.

B. Task two - SME meetings:

We interviewed a small group of dedicated experienced instructors. This information, in conjunction with the literature base, helped us gain a better understanding of what a successful facilitated debriefing would look like in addition to the common barriers to learning experienced. We captured not only those barriers seen, but also those of student participation. These interviews provided a clear appreciation for how to gauge a student’s participation, which is paramount for success. These interviews helped us establish the diversity of approaches used by instructors during debriefing sessions, which in turn will be used as one of several inputs in the development of a standardized training for the instructors.

Prior to collecting data it was necessary to understand from the flight instructors and other subject matter experts 1) what are the known barriers to facilitation and 2) what types of mitigation strategies are successful.
these gatherings was extremely insightful as to the challenges and mitigations now confronted by professional training providers but would also serve as a starting point beyond the current literature base that enabled us to calibrate ourselves with experts in the field. Once finished, this insight was then used to develop the training (e.g. standardization) for the instructors so that results for the structured portion of the diary entry was closely followed.

C. Task Three – Instructor Training and Calibration:

After the SME meeting and prior to collecting data, we provided a training for the small group of dedicated instructors (subjects) that are engaged in facilitated debriefings. Although all are experienced in the act of facilitation, this training was to standardize their debriefings and ensure the same techniques are understood and practiced equally throughout the study. Afterward, we discussed as a group the most common barriers to learning that they have experienced and the mitigation strategies that they have successfully employed.

D. Task Four – Diary Entries/Data Collection:

Task four is the observational study of facilitated debriefing techniques and the submission of the instructors’ diary entries. The results of the first three tasks provide the structure to the design of this study phase of the research. The specific study plan depended on the results of the first three tasks. Traditional diary studies utilize pen and paper; however, it was felt that a recording pen might enhance the capture of the details just experienced. Additionally, instructors received an invitation to join an on-line data repository to deposit their entries.

Although there are several ways to conduct research and gather qualitative data in an observational setting, the general aim is to capture behaviors and actions in natural settings, as in our case a flight training simulator session and more specifically the debriefing portion. The very nature of this research is unpredictable and dynamic. This requires instructors be agile so as to solve educational problems. This lends itself to data collection methods that are qualitative in nature. We believe that this form of data collection is unique and not commonly utilized [10].

2. Task Five/six – Organization and Analysis of Data

Task five was the organization of data so as to develop a better understanding of what was collected and any underlying themes. All of the diary entries were downloaded (43 entries with a total of 7 hours of recordings) and stored on a secure computer as per IRB requirements. Once gathered, we listened to each recording and transcribed the entire diary entry. Once complete, we started to categorization of discovered themes (See Table 1).

<table>
<thead>
<tr>
<th>Times captured in diary entries</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Setting expectations as to how the length of the debriefing once finished</td>
</tr>
<tr>
<td>9</td>
<td>Keeping them as engaged as possible</td>
</tr>
<tr>
<td>6</td>
<td>Pilots are more relaxed and know what to expect with regard to facilitation</td>
</tr>
<tr>
<td>5</td>
<td>Has two features – 1) the set-up period on the area of interest takes a few moments and allows them to gather their thoughts 2) allows them to focus and explore a specific moment in time</td>
</tr>
<tr>
<td>4</td>
<td>Important as it starts the discussion in a positive direction and allows them to feel safe exploring the specific event in question in a facilitated manner</td>
</tr>
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<td>3</td>
<td>Allows for examining the very intent of the training event in addition to offering an anchoring point to start the facilitation</td>
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<tr>
<td>2</td>
<td>Creates an environment of learning and self-education as they needed to understand the question and to ensure that they understand their mental model</td>
</tr>
<tr>
<td>1</td>
<td>Do not worry if they want to discuss events out of chronological order</td>
</tr>
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</table>

We then repeated this review to ensure that all information was adequately captured in our notes.

E. Task Seven – Findings

Of the seven hours of recordings, several trends emerged that help us better understand the role and results of debriefing facilitation after aviation simulator training. Amongst the top few findings are 1) setting the expectation before the entire session starts and 2) asking what they want to take back to the line once finished. Setting the expectation for the debriefing accomplishes several goals. First, it lets the student know that the instructor and operator view the debriefing seriously regardless of the outcome. Second, once in the debriefing they are not simply focused on watching the clock and giving the shortest answers possible to help end the session sooner. This was a finding and recommendation from some of the original NASA work as well.

The third most common was to address the challenge of keeping the students engaged. This had not yet been addressed in the industry literature. This was a challenge that we heard about earlier in both the SME meetings and training session for the instructors. What are the mitigation strategies for keeping the students engaged? Several solutions discussed were using SimVu (video recording of training session) to help pull them back into the discussion with specific points in time captured on the video. Anchoring these points helps the...
students focus on a specific event for exploration and does not require the time intensive and error prone process of trying to recall the details of the event in question. This allows for more cognitive “bandwidth” to focus on exploring this discretionary space for self-reflection. Upon meeting the students for the beginning of the training session and once in the debriefings there were several indications noticed by the instructors that seemed to precede a successful facilitated debriefing event. These include body posture and starting the discussion before out of the simulator as an example.

The results from this study will characterize the range of techniques used in debriefings, the problem encountered, debriefing process, and techniques to enhance the learning results relative to the documented objectives for CRM training. This empirical assessment will produce guidance on conducting facilitated debriefings that can be used by the FAA and by the industry. Directors of Training at individual operators and the FAA will now have the results that will establish the relationship between facilitated debriefings (including best practices on the use of video play back) and improved CRM performance.

F. Task eight – Industry Recommendations

This study offers the aviation industry the first known corpus of data to capture barriers to learning and potential mitigation strategies to facilitation. Here we build upon the original NASA work by capturing both the discovered barriers and their successful mitigations. These findings can benefit across domains that use advanced simulation.

Simulation debriefings are greatly under utilized. They have the potential to significantly increase the learning ability of the students in simulator training in either ATC or flight deck training to name a few. Our work takes this effort to the next logical step by characterizing the debriefing process and the balance between barriers and mitigation attempts.

The last FAA advisory circular on debriefings was updated in the Spring of 2015 but lacks the following two areas 1) specific guidance as to how to conduct a facilitated debrief and 2) how to manage common barriers to learning. Additionally we see this work as being of interest to airlines and major flight-training centers to help define how their instructors should be trained to conduct facilitated debriefings.

IV. CONCLUSIONS

Facilitated debriefings are a greatly underutilized method of a constructive debriefing process in the aviation (ATC and flight deck) educational space. However, prior to our research, the characterizations of the commonly encounter problems and their mitigations had not been researched. Setting expectations for the debriefing process and the explaining the facilitated process before training starts goes a long way in preparing the students to run the debriefing on their own with occasional input for the instructor. By using the facilitation techniques and avoidance of barriers to learning, aviation training offers the students a chance to self-reflect and take this skill their normal operational environment. This ability can add to the practitioner’s skill set so that their analysis and lessons learned from normal events thereby increasing their resilience, this may serve to increase overall safety of their operational position.

REFERENCES


