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Project Title:	Facilitating the Synergistic Side of Cultural Diversity in LDSE: Identification of Challenges and Development of Cultural Training		
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Program/Discipline--Element/Subdiscipline:	HUMAN RESEARCH--Behavior and performance		
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Task Description:

Culture has been a factor for space exploration since the mid 1970s when the U.S. first partnered with Russia. Work has indicated that culturally-based differences in values, beliefs, and preferences for cognition and action can have an impact on interdependent action (Stahl et al., 2010). Cultural diversity can pose challenges for a number of transition, action, and interpersonal processes and emergent states in teams. However, almost all of this work has been conducted outside the context of spaceflight. The little work that has been conducted within spaceflight has begun to suggest that the impact of culture on teams may be different in long-duration space exploration (LDSE--see Suedfeld et al., 2013). This drives the question as to whether cultural diversity within spaceflight crews has the same impact on team performance as that reported within the wider literature on cross-cultural teams and what can be done to create synergy. We leverage prior work on cultural diversity and teams in mission critical environments and archival data on team interaction in ICE (isolated, confined environments) and pair this with experimentation in ground analog studies to better understand the critical challenges created by cultural diversity in LDSE and use this information to create and test cultural training tools that can be used pre- and in-flight. Specifically, we take a multi-pronged approach to answer the following questions: (1) what are the critical issues surround culture and team performance in LDSE, (2) from a compositional standpoint is there an 'ideal' team profile in terms of cultural orientations to facilitate team performance and adaptability in LDSE, (3) what types of cultural training can be developed for use pre-flight and in-flight, and (4) what tools can be developed to facilitate practitioners in maximizing the potential synergy in culturally diverse teams operating in LDSE (e.g., pillars, guidelines, practices, tips).

Stahl, G.K., Makela, K., Zander, L., & Maznevski, M.L. (2010a). A look at the bright side of multicultural team diversity. *Scandinavian Journal of Management*, 26 (4), 439 - 447.

Stahl, G. K., Maznevski, M. L., Voigt, A., & Jonsen, K. (2010b). Unraveling the effects of cultural diversity in teams: A meta - analysis of research on multicultural work groups. *Journal of International Business Studies* , 41 (4), 690 - 709.

Suedfeld, P., Wilk, K. E., & Cassel, L. (2013). Flying with strangers: postmission reflections of multinational space crews (pp. 185-209). Springer, Berlin Heidelberg.

Rationale for HRP Directed Research:**Research Impact/Earth Benefits:**

Within this project, we seek to answer the following questions: (1) what are the critical issues surrounding culture and team performance in long duration spaceflight, (2) is there a team cultural profile that facilitates team performance and adaptation in long duration spaceflight, and (3) what tools can be developed to facilitate synergy/mitigate decrements in teamwork and team performance within culturally diverse teams operating in the context of spaceflight.

The proposed project will impact numerous areas. First, this research will address current theoretical gaps surrounding the critical challenge of cultural diversity in long duration spaceflight (both on the ground and in orbit). This information is then used to build a series of complementary, modular training tools to facilitate the crew's ability to turn cultural diversity into a synergistic force. The existent literature on cross-cultural training does little to focus on cultural diversity in crews operating in isolated, confined environments. Additionally, the focus of most cross-cultural training programs is to prepare expatriates to go abroad; therefore, teaching cross-cultural competence with regard to teamwork skills is rarely seen. In building our training we seek to validate the effectiveness of such programs within analog environments using sound scientific methods and training evaluation techniques. Finally, as an important part of training development is the assessment of the skills gained during training we will also deliver a set of assessment tools that can be used to diagnose cross-cultural competence levels with regard to team interaction.

Efforts within the current reporting period have primarily focused on three areas: 1) initial analysis of data from the 4-month Scientific International Research In a Unique terrestrial Station (SIRIUS) mission in the Nezemnyy Eksperimental'nyy Kompleks (NEK), (2) analysis of a subset of interview transcripts obtained from the Johnson Space Center (JSC) Oral History Project, (3) preparation for upcoming 8-month SIRIUS mission. While insights were gained through the analysis of the transcripts pulled from the JSC Oral History, here we focus most prominently on the initial insights gained with respect to the data coming out of the 4-month SIRIUS mission. However, note that the data presented herein is preliminary and action on any results should be viewed with caution due to the low sample size (1 crew, 6 individuals). Remaining missions will serve to provide greater confidence in initial results and allow us to move towards team level analyses. Results also need to be viewed in light of the fact that results from both quantitative and qualitative data suggest that in terms of cultural diversity the SIRIUS 4-month crew was on the low to moderate end of the spectrum for those cultural values that were assessed.

Some of the differences noted by the crew were differences in language fluency, boundaries, and leadership style. Difference in language fluency were a big focus and some crew highlighted that this could lead to misunderstandings and not 'getting' everything that was said, including humor. Differences in boundaries were also noted and primarily dealt with how much to 'share,' notations of the crew as family, and that variability in how much personal information was appropriate to share may make bonding more difficult for some. A final factor that will be highlighted was the leadership style within the crew. The style was very hierarchical which some felt may have been driven by culture, but some felt it was also driven by the tremendous 'expertise' and 'recognition' of the commander. Crew members reported that while cultural differences existed, they did not pose challenges to task accomplishment within the 4-month mission. While this finding is similar to previous findings with missions around the same length (Burke & Feitosa, 2015), crew composition issues related to gender and nationality were also cited as a contributing factor to team dynamics within the crew. Moreover, a general openness to learn within the crew and an awareness that cultures are different was also seen as contributing to positive team dynamics.

Despite the low to moderate cultural diversity within the crew, quantitative results begin to suggest how cultural values may impact crew member perceptions of team dynamics, emergent states, and performance. With regards to team dynamics, several cultural values were found to significantly impact perceptions of teamwork. Specifically, crew members who possessed any of the following were found to report lower perceptions of teamwork: higher levels of power distance, higher comfort with uncertainty, long-term orientation, and values indicative of an indirect communication style. While there were some differential impacts of the above cultural values when examined at the teamwork subscale level (i.e., communication, cohesion, conflict, attitudes) those will not be discussed here as in most cases they align with the teamwork composite. While the degree to which an individual held values indicative of collectivism or masculinity was generally not seen to be related to perceptions of teamwork at the composite level, some impact at the subscale level was seen. Specifically, as collectivism increased perceptions of team cohesion decreased.

	<p>In most cases, the above values also led to lower perceptions of positive emergent states (e.g., cohesion, attitudes, trust, identity) and higher perceptions of negative emergent states (e.g., faultline development, conflict). The exception to this was that long-term orientation was not significantly related to identity, faultline development, or conflict. Furthermore, indirectness was not related to cohesion, identity, or faultline development. In terms of the impact on perceptions of team effectiveness, results indicated that higher levels of power distance, more comfort with uncertainty, more collectivistic values, masculinity, or a long-term orientation all caused individuals to perceive lower levels of team effectiveness.</p> <p>Task Progress:</p> <p>Not surprisingly the degree of cultural intelligence also impacted perceptions of team dynamics, emergent states, and performance. Results suggest that as cultural intelligence increases so do perceptions of teamwork (and its subscales – attitudes, communication, cohesion, and decreases in reported conflict). Moreover, perceptions of positive emergent states (i.e., trust – affective and cognitive-trust and identity) increase while negative states decrease (i.e., faultline development). Finally, perceptions of team effectiveness increase as cultural intelligence increases. The results for the subscales that comprise cultural intelligence were found to align fairly closely with the overall composite.</p> <p>Analysis of the data obtained from transcripts within the JSC Oral History project has tended to provide additional support to several of the findings that are emerging from the SIRIUS data collection. Qualitative coding of a subset of the transcripts obtained from the JSC Oral History project highlighted twelve areas as potential challenges to team interaction within culturally diverse spaceflight crews, including: differences in language, differences in philosophies, failure to integrate, differences in experience, differences in leadership style, differences in processes and rules, differences in thinking, gender differences, hierarchy, failure to share workload, and limited information sharing. Additionally, a number of factors that serve to mitigate the impact of cultural diversity were also highlighted. The most commonly used mitigating mechanisms included: socializing/building relationships, working towards team goals and communication along with adaptation/acquisition, cultural awareness/understanding each other, humor, knowledge and information sharing, and negotiation. To a lesser degree, things such as recognizing each other/providing praise and being able to recognize the social environment and pick up on cues were mentioned. Pulling from the data within the SIRIUS crew journals and interviews, we also see several additional ways that cultural awareness and cohesion can be built among the crew, including: language clubs [Russian-English, English-Russian], language socialization, use of movies and music as ways to transmit and discuss culture, and the importance of mealtime for building cohesion and understanding. The importance of both formal and informal mechanisms was noted.</p> <p>Finally, additional data extracted from crew interviews and journals provide information on the role that isolation may occupy with respect to the impact of cultural values and team dynamics. For example, some crew members noted that isolation may cause individuals to identify more with their ‘origins’ (e.g., want to share it more with others). Additionally, isolation was brought up as a factor that may contribute to a blurring between professional and social boundaries as the crew becomes more like a ‘family.’</p> <p>Moving forward we will continue to analyze the remaining information contained within the 4-month mission and look forward to the opportunities that will be afforded within the 8-month mission such that with both data sets we can begin to talk about cultural diversity in more detail. We will also continue to utilize the information gained to this point to prepare for the SIRIUS 8-month mission. With respect to the SIRIUS mission, the project team has attended planning and update meetings as well as begun to complete the necessary protocols and delineate the constructs that will be focused upon for our part of the mission, as well as the timing of specific measures. It is expected that in examining the primary research questions above information on: individual differences (i.e., cultural values, cultural intelligence, personality, social intelligence), team processes and states (i.e., teamwork, shared mental models, faultlines, and positive/negative affect), and outcomes (i.e., team effectiveness) will be collected. Additionally, crews will engage in journaling activities that will provide a more qualitative in depth understanding of their experiences while in the analog with respect to team interaction and culture. Finally, additional data collection/analysis opportunities (e.g., 8-month mission), will serve to refine our initial findings and facilitate the integration of this information into the products we are building.</p>
Bibliography Type:	Description: (Last Updated: 09/04/2023)
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Books/Book Chapters	Burke CS, Feitosa J, Moavero J. "Towards an understanding of training requirements for multicultural teams in long duration spaceflight." in "Psychology and Human Performance in Space Programs: Research at the Frontier." Ed. L.B. Landon, K.J. Slack, E. Salas. Boca Raton, FL: CRC Press, 2020. https://doi.org/10.1201/9780429440878 , Oct-2020