Application of DEJI® Systems Engineering Model in the Development of a New Faculty Mentoring Program in Higher Education

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Abstract

A case example is presented for developing a new faculty mentoring program at the Air Force Institute of Technology (AFIT) using the Design-Evaluate-Justify-Integrate (DEJI) systems engineering model. AFIT is a graduate school of engineering and management, and technical professional continuing education for the United States Air Force. It provides advanced education to the Air Force and other military and government organizations. This case example provides a structured approach that can be followed to design, evaluate, justify, and integrate elements of any new work design, such as developing and executing a faculty mentoring program in an unconventional educational environment.

Introduction

Formal mentoring is defined as a program established by an organization that purposely matches mentors and mentees so the employees can share their knowledge and expertise [1]. "Mentoring is traditionally a process in which an experienced person (the mentor) guides another person (the mentee or protégé) in the development of his or her own ideas, learning, and personal/professional competence" [2]. According to Thomas, Bystydzienski, & Desai (2015), mentoring of faculty in higher education has been recognized as an important method for assisting them in obtaining tenure and promotion and developing a sense of support and belonging, resulting in lower rates of attrition [3]. Sorcinelli (1994) cites studies that uncover some of the first year concerns of junior faculty, which include feelings of loneliness, isolation, lack of social and intellectual stimulation and inadequate support from senior faculty members

[4]. Costs associated with faculty attrition in higher education is sizeable and mentoring has been proposed as a tool for retaining faculty [5].

Klinge (2005) describes the consequences of mentoring in terms of benefits to the mentee, mentor, and organization [2]. The mentee can gain knowledge and supportive feedback from the mentor. The mentor can acquire a learning partner and sense of purpose and fulfillment. Additionally, the organization can obtain improved employee performance and productivity, employee enthusiasm and collaboration, and cost-effectiveness in employee retention. Despite these benefits, Fountain and Newcomer (2016) identified five challenges with formal mentoring programs: time constraints, unclear expectations, lack of interest or motivation by faculty, insufficient resources, and lack of incentives/rewards for mentoring [6]. To avoid these challenges, this paper provides a case example for developing a new faculty mentoring program at the Air Force Institute of Technology (AFIT) using the DEJI systems engineering model

Background

AFIT is a graduate school of engineering and management and has technical professional continuing education for the United States Air Force [7]. AFIT is a military organization with an educational mission. AFIT provides advanced education to the Air Force and other military and government organizations. The faculty is composed of military and civilian educators. The military faculty rotate on average every three years from their faculty positions into other Air Force assignments. As a result, this environment requires an adaptive and agile faculty mentoring program to accommodate military and civilian faculty members and facilitate expedient adaptation to their new roles.

The focus of this paper is on the development of a mentoring program for new faculty. This work provides a model for establishing and evaluating a formal mentoring structure at AFIT. The goals of the new faculty mentoring program are to:

- Enhance the opportunity for new faculty to engender a sense of belonging
- Improve the new faculty's understanding of their roles and responsibilities
- Support teaching and research excellence
- Encourage collaboration and cross-disciplinary engagement

Embedded in such a program is a need to expose junior faculty to the tools for curriculum development, which is one of the tasks faculty members will have to face. Thus, the DEJI systems model presented in this paper has the dual purpose of an application for faculty development program as well as an illustration of how the model can be applied to curriculum development. Although several theories are available in the literature for curriculum development, such as [8, 9], the process used for each model is often ad hoc. Using a systematic approach to develop a curriculum could facilitate faculty development, as far as managing an academic curriculum is concerned. Figure 1 shows how the essential elements of the DEJI model can be applied directly to the parts and pieces required in curriculum development.

Understanding the framework in the figure will enhance the understanding of new faculty in how a faculty development program itself utilizes a systematic approach. Essentially, the DEJI model impacts a systematic process structure to the challenges of a faculty development program and/or a curriculum development effort.

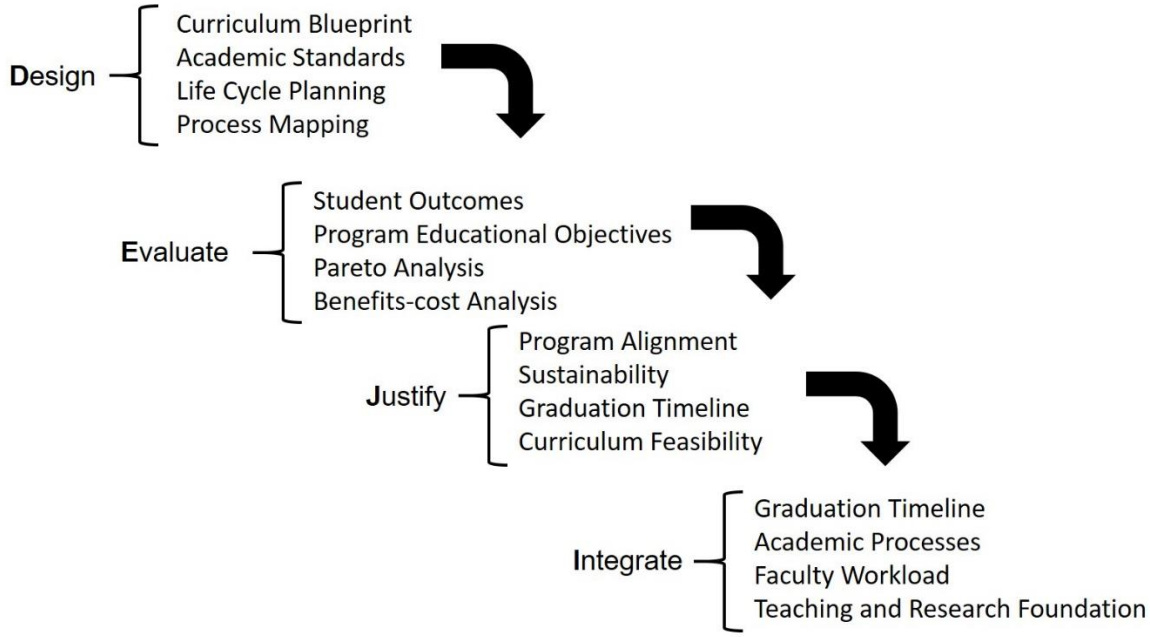

Figure 1. **DEJI**® Model Application to Curriculum Development in Alignment with Faculty Development Program

The case example presented utilizes the DEJI systems engineering model [4], which advocates a structured approach that can be followed to Design, Evaluate, Justify, and Integrate elements of any new work design, such as developing and executing a mentoring program. In this particular case example, a New Faculty Development and Mentoring (NFDM) model is illustrated to enhance faculty development in higher education for an unconventional educational environment, such as the Air Force graduate school. The structure of the mentoring program including the embedded evaluation processes will be presented, and how the collected evaluation data will be used in a feedback loop of continuous quality improvement.

Methodology

When deciding to develop a new process or procedure, a systems approach is best for effective project management. A systems approach in the early stage of process development makes it possible to assess feasibility and adaptability of the work design, along with the integration into regular operations. To carry out the development of the proposed new faculty mentoring program, the Design-Evaluate-Justify-Integrate (DEJI) model was chosen to systematically

execute the process implementation strategy, assess results, and integrate the process elements that work.

DEJI® model

Figure 2 illustrates the DEJI model for systems integration of work design [10]. The DEJI model queries the engineer or analyst at each stage of work development (design, evaluate, justify and integrate) to reduce the risk of neglecting critical requirements. The greatest aspect of the DEJI model is the final stage: integrate. Integration is critical for process sustainability.

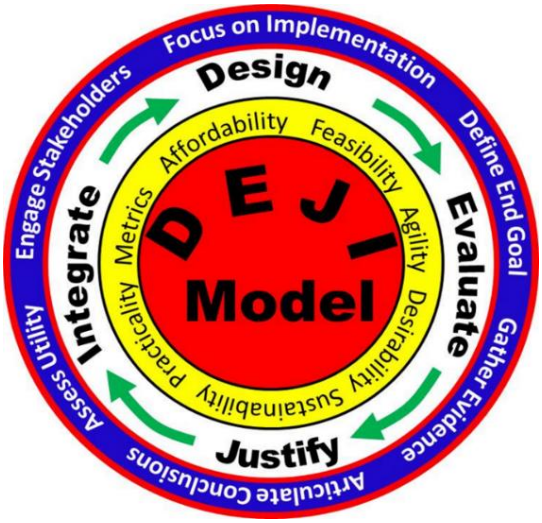

Figure 2. **DEJI®** Model: Design, Evaluate, Justify and Integrate

According to Badiru and Bommer (2017), the following defines the process of the DEJI model for work design [11]. In this paper, the design of a mentoring program is analogous to a "work design" process. The steps are outlined as shown below:

Step 1. Work *design* involves the planning or selection of system elements. Interdepended elements with the purpose of accomplishing an overarching outcome creates a project system. This step of the model guides the work designer into strategically considering work elements for long-term sustainability of the project system.

Step 2. In efforts to *evaluate* work, performance measures must be properly defined for process improvements. The benefits of process measures include:

- To determine whether requirements are being met
- To assist an organization with problem identification
- To ensure fact-based decisions
- To support process improvements
- To demonstrate if improvements were achieved
- To reveal problems related to bias and emotion

Step 3. Work *justification* involves checking whether the work elements are needed in the system. This is the process of eliminating elements that do not add value to the overall design.

Step 4. Work *integration* is critical when introducing new work into an existing system, because it requires coordination of new operations to coexist with existing operations. If a work element is not integrated well with normal operations, it cannot be sustained long-term.

Implementation Strategy Using the *DEJI*® Approach

The implementation strategy (Figure 3) deploys a thirteen-step approach to implementing a mentoring program for new faculty members.

DEJI Model	STEP	TASK
DESIGN	1	Assess organizational goals and needs
	2	Establish team to facilitate program
	3	Conduct literature review for best practices
	4	Develop mentoring goals and plans
	5	Department Heads briefing
	6	Identify mentees
	7	Identify individuals to serve as mentors
	8	Match mentor-mentee pairs
	9	Conduct mentor-mentee training/kick-off
EVALUATE	10	Facilitate program activity and collect performance data
JUSTIFY	11	Validate program elements
INTEGRATE	12	Develop continuous improvement plan
	13	Debrief appropriate school administration

Figure 3. Program Implementation Strategy

Step 1 requires assessing the goals and needs of the organization. During this step, the gaps in the organization are identified and how those gaps can be addressed with a formal mentoring program. In Step 2, a team is established to lead planning activities, program monitoring, and program data analysis. During Step 3, a literature review is conducted to identify best organizational practices. Next, mentoring goals, planned activities, and evaluations methods for program effectiveness are developed in step 4. Step 4 defines the end goal. Step 5 recommends briefing the department heads on the program to garner support for integration into existing organizational operations. It is important to engage stakeholders early in the process. Step 6

identifies those faculty members eligible for the mentoring program. Alternatively, Step 7 identifies senior faculty members willing to serve as mentors. Mentor-mentee matching takes place during step 8. Appropriate mentee-mentor matching is vital to the program; a mismatch could result in a strained relationship [12] and unmet goals for the mentee. For this study, mentor-mentee pairs were matched by their perspective department heads. Step 8 is an important step for the development of the mentee. After the mentor-mentee matching is complete (Step 8), an introductory meeting (Step 9) is held to orientate the mentors and mentees on the goals and plans of the program. During the introductory meeting, a training session for the mentor-mentee pairs is conducted to enhance their understanding of their roles. Step 10 comprises the facilitation, data collection, and tracking of measures for program activities. The New Faculty Development and Mentoring (NFDM) model (Figure 3) is executed at this step to support activity development. When creating the program activity plan, the challenges of formal mentoring as previously discussed, should be considered along with devising a plan to overcome those challenges. Validation of the program elements is reviewed during step 11 using the data collection from Step 10. This data is used to determine whether each program element is necessary and to identify elements that could be improved to create a more effective program aligned with the organizational and program goals. Upon completion of all activities and performance evaluation, a continuous improvement plan is created (Step 12) using the measurement data collected throughout the program. Step 13 is the final step of the implementation strategy. In this step, the conclusions of the study are articulated in a briefing to appropriate administration on the program performance.

Framework/Model

The New Faculty Development and Mentoring (NFDM) Model (Figure 4) is a conceptual framework designed to formalize mentoring for new faculty development in higher education. The NFDM is constructed in an adaptable manner such that it can be applied across various domains and organizational structures. The NFDM model is made up of an organizing committee and a performance feedback loop of the key program elements.

There are three key program elements of the NFDM to support new faculty mentoring: peer mentoring groups, mentor-mentee relationships and workshops. *Peer mentoring groups* are formative communities of groups with like interest. These groups are typically made up of two or more people of equal status and can vary from a small group to a large network. However, at AFIT, the groups may vary in military rank status and are composed of eight or less faculty members. These groups may discuss strategies to include new ideas and polices that can be utilized for transforming institutional cultures to meet various needs of faculty [3]. Next, the primary focus of the program resides in the middle of NFDM Model (Figure 4) with the *mentor-mentee relationship*. The mentor-mentee pairing is coordinated by the Head of each department. Lastly, regularly scheduled *workshops* on specific topics related to higher education practice are conducted as a resource for new faculty members.

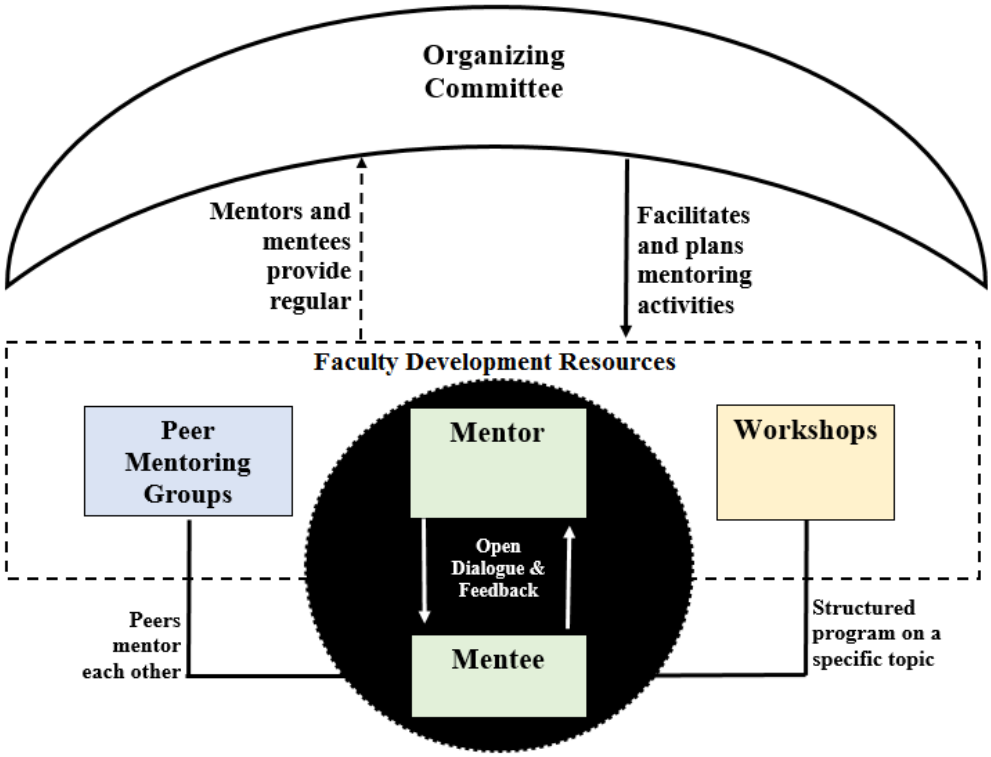

Figure 4. New Faculty Development and Mentoring (NFDM) Model

Organizing Committee

The role of the organizing committee is an integral component of the NFDM. The organizing committee for the pilot program is made up of four people. Figure 5 illustrates the structure of the committee.

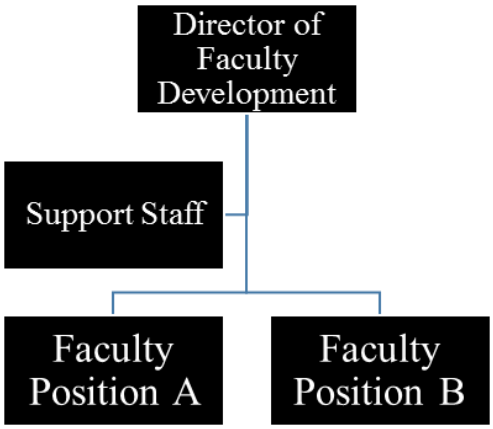

Figure 5. Program Organizing Committee

The program is facilitated by the Department of Faculty Development. The Director of Faculty Development is the Program Leader, responsible for overall execution of the program. The

support staff member researches best practices, develops measuring tools for data collection, and tracks program progress by analyzing the data collected from the measuring tools. Faculty Position A and Faculty Position B are voluntary advisory roles on the committee. These faculty representatives are drawn from the Faculty Development Advisory Council. The two faculty members selected represent both military and civilian faculty, with one member from each category. The faculty selected for the committee are both experienced professors and researchers with extensive knowledge of the organization.

Program Activities

The pilot program is designed to minimize the workload needed for program execution. It requires minimal participation requirements, training and reporting. The program outline is shown below (Figure 6). Mentors and mentees are encouraged to meet once each month at a minimum. A bi-monthly workshop is held on a topic in academia regarding teaching or research development. Also, a new faculty peer-mentoring group meeting is held bi-monthly.

Timeframe	Elements	Evaluation Method
Month 1	Mentor briefing	Survey
	Mentee briefing	Survey
	Hold a kickoff meeting for mentors to meet mentees	Attendance sheet
Month 2	Mentor-Mentees are encouraged to meet	Questionnaire
	Workshop	Survey
Month 3	Mentor-Mentees are encouraged to meet	Questionnaire
	Peer Mentoring Group	Survey
Month 4	Mentor-Mentees are encouraged to meet	Questionnaire
	Workshop	Survey
Month 5	**Mid-Program Evaluation**	**Focus Group**
Month 6	Mentor-Mentees are encouraged to meet	Questionnaire
	Peer Mentoring Group	Survey
Month 7	Mentor-Mentees are encouraged to meet	Questionnaire
	Workshop	Survey
Month 8	Mentor-Mentees are encouraged to meet	Questionnaire
	Peer Mentoring Group	Survey
Month 9	Mentor-Mentees are encouraged to meet	Questionnaire
	Workshop	Survey
Month 10	End-of-program get together and awards ceremony	Attendance sheet

Figure 6. Program Elements and Associated Evaluation Methods

Evaluation Methods

Three performance metrics (Figure 7) were identified for measuring effectiveness of the new faculty mentoring program: participation, satisfaction, and impact on teaching and research.

Metric	Measure	Data Collection Method
Participation (Who is participating?)	Track attendance at meetings and workshops	Use sign-in sheets as attendance records
	Track frequency of mentor-mentee meetings	Questionnaires
Satisfaction (What was the participant's level of satisfaction?)	Satisfaction with mentoring program, mentor-mentee relationship, program training, resources and support, etc.	Solicit feedback using surveys
Impact on Teaching & Research (Did participants develop or change their practices as a result of the program?)	Mentee satisfaction	Focus Group/Interviews

Figure 7. Program Evaluation Methods

Attendance is tracked at each program event to measure participation. After the one-on-one mentor-mentee meetings, the mentees and mentors are requested to complete a short online questionnaire to document and track meeting attendance. Satisfaction surveys are used to solicit feedback regarding the workshops and peer mentoring groups. Also, there is an end-of-year survey to measure program effectiveness regarding the mentee's perceived impact on teaching and research.

Discussion

This paper provides a case example of a step-by-step approach to developing a mentoring program in higher education using the ***DEJI***® systems engineering model. Most military faculty at AFIT are on a short-term assignment, so the mentoring program is developed to help the mentee adapt to his/her new role in an expedient manner. Therefore, a pilot study is performed to test the program.

The pilot program is currently ongoing. At month 5 (Figure 6) a mid-program review will be performed to gauge overall impact of their mentor-mentee relationship, training, and support. Data gathered to date indicate overall satisfaction with the programs structure, implementation and purpose. Additional prompts have been incorporated into the data collection system to encourage timely submission of evaluation feedback. This change has resulted in a 200% increase in feedback responses received. This is a critical factor in the program's success as continuous improvement of the system would not be possible with insufficient data.

Disclaimer

The views expressed in this paper are those of the authors and do not reflect the official policy or position of the United States Air Force, the Department of Defense, or the U.S. Government.

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