The Behavior Engineering Model Assesses Knowledge Transfer in the Training Environment: A Call for Performance Feedback

Amy Rosellini and Nicole Bank

Information Science, University of North Texas, Discovery Park, Denton, TX, U.S.A.

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Abstract: Gilbert's Behavior Engineering Model provides a framework for evaluating effective knowledge management systems. However, this model lacks continuous testing in the training landscape of companies today. This study tests the utility of the Behavior Engineering Model to identify a gap in a knowledge management system. The case study follows nine airline workers through a post-training performance assessment. Results reveal trainees obtain inaccurate performance reports from supervisors. The Behavior Engineering Model reveals a lack of supervisor feedback prevents knowledge transfer in this training environment. Both of these performance deficits are due to areas of need in Gilbert's first component of the model: data. Utilizing contemporary studies calling for current research into Gilbert's model, this case study aims to show how the Behavior Engineering Model is relevant to knowledge management systems today.

1 INTRODUCTION

Thomas Gilbert's Behavior Engineering Model is a framework to improve human performance and affect behavior. Formal knowledge management systems often exist in a training environment with the same purpose – to improve worker performance and impact behavior change through knowledge transfer. This study utilizes the Behavior Engineering Model (BEM) as a guide to investigate the practical utilization of the model within an active knowledge management system. The nature of a formalized training environment provides the ideal setting to demonstrate how knowledge transfer impacts behavior change. Current studies suggest continued contemporary testing of the BEM to understand its relevance today in impacting human performance improvement.

2 BACKGROUND

2.1 Knowledge and Knowledge Management Systems

Knowledge is "information combined with experience, context, interpretation and reflection" (Davenport, 1998, p. 43). Knowledge can be stored, organized, protected, used or shared. The sharing of knowledge is referred to as knowledge transfer, it's how knowledge passes from one individual and is accepted by another individual (Wathne, Roos & von Krogh, 1996). A common knowledge transfer context is within an organization. Companies transfer knowledge through formal means – training programs, mentorship – and informal means – social relationships, environment (Nonaka & Takeuchi, 1995).

Knowledge management is the process of creating, sharing, using and managing the knowledge and information of an organization (Girard & Girard, 2015). The idea of knowledge management as a system is born from the socialisation, externalisation, combination and internalistion (SECI) model (Nonaka & Takeuchi, 1995). SECI identifies knowledge as a continuous operation. The spiral of SECI shows the cycle of knowledge creation and the importance of both the individual and context or environment (Nonaka et al., 2007).

The formal processes used to distribute knowledge in a firm whether through training programs, mentorship, access to information systems or other means allows for the transfer of many types of knowledge. Newell et al.'s (2000) model showing the diffusion of complex ideas to commodified knowledge demonstrates how a knowledge management system (KMS) in a company must be as

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much user- or employee-focused as supplier or company focused in order to meet the company's knowledge goals. An understanding of the employee and their network is critical to an effective KMS. Furthermore, KMS evaluation and assessing whether knowledge has been effectively transferred can be measured by the performance of the intended recipient. Effective KMS facilitate knowledge transfer which translates into better productivity as a company.

In the context of a training scenario, new employees must acquire new knowledge to perform their jobs. This knowledge is often shared formally through presentations, handbooks, and orientations and informally through social exchange and observations. Effective knowledge management of new-hire information ensures the employee has everything they need to perform their role as expected. When the knowledge management system works, new-hires demonstrate acceptable job performance. A measurement performance tool that evaluates job behaviors allows the company to accurately measure the efficacy of knowledge transfer.

When the newly hired are not meeting expected performance standards, it is the organization's responsibility to make the appropriate adjustments. Companies can intervene into a knowledge system, whose parts by working together, make performance emerge. (Wittkuhn, 2016). Improving effective knowledge management in the training environment requires intervention where the information is shared or where the information is used. Thomas Gilbert supported a similar perspective when identifying deficits in performance. "For any given accomplishment, a deficiency in performance always has as its immediate cause a deficiency in a behavior repertory, or in the environment that supports the repertory, or in both. But its ultimate cause will be found in a deficiency of the management system" (Gilbert, 1996, p. 76). Knowledge management system effectiveness relies on the ability of a change in worker knowledge to lead to change in worker behavior, thus impacting company performance. (Martínez et al., 2016; Graham et al., 2006; Newell et al., 2000; Nonaka & Takeuchi, 1996; Rosellini, 2017).

2.2 Behavior Engineering Model

Thomas Gilbert's contributions to human performance were instrumental in creating optimal performance management. Diverting from the popular process-centered improvement initiatives, Gilbert's contributions shift focus toward worker abilities and worker performance that lead to organizational gains. Gilbert's unique model classi-

	Information	Instrumentation	Motivation
Environment	*Data* 1. Relevant and frequent feedback about the adequacy of performance 2. Descriptions of what is expected of performance 3. Clear and relevant guides to adequate performance	*Resources* 1. Tools, resources, time and materials of work designed to match performance needs	*Incentives* 1. Adequate financial incentives made contingent upon performance 2. Non-monetary incentives made available 3. Career-development opportunities 4. Clear consequences for poor performance
Individual	*Knowledge* 1. Systematically designed training that matches the requirements of exemplary performance 2. Placement	*Capacity* 1. Flexible scheduling of performance to match peak capacity 2. Prosthesis or visual aids 3. Physical shaping 4. Adaptation 5. Selection	*Motives* 1. Assessment of people's motives to work 2. Recruitment of people to match the realities of situation

Reference: Dr. Thomas F. Gilbert, "Human Competence: Engineering Worthy Performance," 1978, 1996

Figure 1: The behavior engineering model.

fies the possible causes of performance deficits and provides a roadmap toward performance improvement.

As most evidence-supported theories do, Gilbert's BEM has endured a series of iterations by Gilbert himself (Gilbert, 1978; Gilbert, 1982; Gilbert, 1996) and others (Binder, 1998; Marker, 2007). However, the crux of the theory still holds; organizational accomplishment is rooted in what the employees themselves accomplish. Gilbert proposed employee performance is affected by six key factors from two distinct locales: factors from the employee's work environment and factors from the individual employee. A simplified version of Gilbert's Behavior Engineering Model is shown in Figure 1. At the environmental level, Gilbert's BEM suggests performance is related to information provided, resources available and incentives arranged for the employee to engage in adequate performance. At the individual level, Gilbert suggests performance can also be related to their knowledge, capacity and motivation.

Early iterations of the BEM provided a roadmap for troubleshooting performance deficits. Focusing on the environmental variables first, Gilbert (1996) suggests starting at the information factor: Do employees have a clear description of expected performance and do they know how well they are performing against that standard? If this seems adequately addressed, focus on the instruments' factor: Do employees have the tools and supplies required to meet their performance expectation? If tools are in place, focus on the incentives factor: Are there incentives that are provided when employees are performing well? When the environment is adequately addressed, move on to the individual level. Start with knowledge: Does the employee know enough to be able to do their job as expected? If that is in place, focus on the capacity factor: Do they have the physical ability to perform as well as expected? And last, if those are all adequately addressed, focus on the motives factor: Are they willing to do the work for the available level of compensation (both monetary and otherwise)?

The BEM has proven relevant for decades (Cox, 2006; Crossman, 2010; Gilbert, 1978). Turner and Baker (2016) laud the continued testing and retesting of theories and models like BEM while calling for further contemporary testing of BEM. Additionally, current studies stress the lack of research in training of proper feedback to ensure behavior change in a knowledge management system (Al Wahbi, 2014; Dobbelaer et al., 2013; Mitchell et al., 2013). Ross and Stefaniak (2018) address the literature gap with their study on the first component of BEM data as feedback. Given the proven utility of the BEM in other organizational settings, the study utilized BEM as a guide to investigate how well managers are providing feedback in a training environment.

The purpose of this study is to continue testing of BEM and to serve as an example of how the model lays the groundwork for identifying gaps in a knowledge management system. This is a demonstration of how the BEM can be used to troubleshoot a knowledge management system.

Research Question: How can the Behavior Engineering Model troubleshoot performance deficits in the context of KMS evaluation?

3 KNOWLEDGE TRANSFER ASSESSMENT AND CASE STUDY

3.1 Setting

A case study was conducted at an international U.S.-based airline in 2019 to understand the reliability of supervisor assessments of trainees. The goal of the research team and airline was aligned – to determine the effectiveness of knowledge transfer in a training environment within a knowledge management system (Rosellini & Hawamdeh, 2020). An airline was selected for this case study because the company and federal agencies (e.g., Federal Aviation Administration) require an hours and performance standard for in-flight personnel before they are allowed to perform work. Therefore, the knowledge to be transferred and subsequent trainee performance were clearly outlined. The Federal Aviation Administration provides airlines with an in-depth and detailed scope of all the skills required to provide a minimal training program (FAA, 2019a; 2019b). The success of the training program for flight attendants is critical to not only their own safety, but to all of those that travel on the airline. At the completion of training, the Federal Aviation Administration requires an observation of the trainee where a supervisor observes the trainee perform assigned job duties for a minimum of five hours (LII, 2020), a convenient process with which to measure knowledge transfer resulting in adequate job performance. This case study occurred during the post-training observation of nine trainees to determine if the knowledge management system facilitated knowledge transfer and behavior change.

3.2 Method

This study utilizes a phenomenological qualitative approach with case study. The sample size includes nine instances where trainees are observed in their post-training job behaviors. The sample size is a convenience sample selected on two different dates within a single cohort of flight attendants completing their multi-week training. The age and gender of participants were not gathered in this study as data was provided anonymously be the airline. Due to budgetary constraints, scheduling was the primary concern of the subjects studied. All trainees included flight take-off and landing in the same departure city on the same day.

3.3 Data Collection

Each trainee was observed by a supervisor during the post-training flight observation. The flight observation is the FAA-required assessment for trainees to perform their assigned job duties while a supervisor observes the trainee for job proficiency. For this case study, a knowledge worker – an employee associated with the airline training department – was also assigned to observe the flight of each trainee. Knowledge workers were trained how to utilize the performance measurement tool before they were asked to observe the trainees. Supervisors are trained how to utilize the performance measurement tool in annual training sessions.

The eleven job tasks that are observed by knowledge workers were selected based on the feasibility that a knowledge worker can observe them in-flight from their seat and the ease to judge if the task is performed. No prior experience is required to understand the eleven job tasks measured. At request of the airline, the job tasks are not included for publication.

The instrument used to measure job performance included a four-part reporting scale of eleven job tasks that were visible to the knowledge worker and supervisor. The instrument is designed by the airline in partnership with the FAA to ensure it meets federal requirements.

The instrument includes a rating scale where tasks are reported as: (0) Not Applicable/Did not Perform, (1) Needs Improvement, (2) Competent with Feedback, and (3) Competent. Nine trainees performed eleven tasks that were observed by both the supervisor and knowledge worker for a total of 99 job tasks observed by both supervisor and knowledge worker.

4 RESULTS

The case study revealed that the supervisor and knowledge worker agreed on the trainee's ability to perform a job task only about half the time. The results showed that for each task performed, the knowledge worker scored trainees the same or lower than the supervisor. The results do not include a single instance where the knowledge worker scored the trainee higher on any task than the supervisor scored the trainee. Out of 99 total job tasks observed by both the supervisor and the knowledge worker, they disagreed on performance metrics on 50 observed tasks. Figure 2 depicts the disagreement between the average score of each trainee for all eleven tasks performed revealing 17.1% difference in the average score by supervisors versus knowledge workers.

4.1 Trainee Performance

BEM: Data Component After identifying the variance between the scores of supervisors and knowledge workers for the same human performance, the company can benefit from using the Behavior Engi-

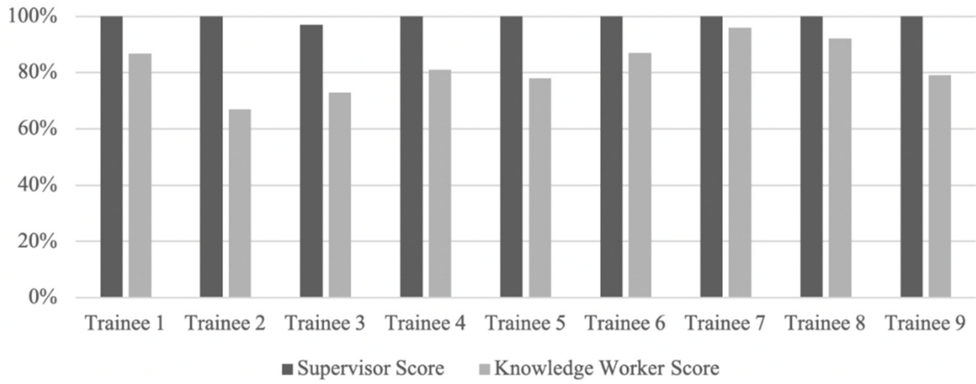

Figure 2: Variance between supervisor and knowledge worker scores. Eleven tasks were performed by nine trainees.

neering Model to understand if this variation is due to a gap in the knowledge management system.

Using the Behavior Engineering Model as a guide, deficiencies in the knowledge management system are identified for management. More importantly, the identification of the knowledge system breakdown allows management to identify *how* to fix areas of concern.

When assessing the efficacy of a knowledge transfer environment, Gilbert suggests starting with the component that identifies data provided in the environment. This starts with the question, Are the data provided a sufficient, informative and reliable guide both to how one should perform and how well one has performed? (1978, p. 91). That is, do the trainees know what they should be doing and how well they are performing against that clear description of expected performance?

Starting with this *data* component, this knowledge management system demonstrated a breakdown in information provided in the environment. This first component requires the worker to understand adequate performance by understanding how well they are performing. In the performance observation conducted, this study reveals that the trainee received feedback that scored performance 17.1% higher on average than a knowledge worker scored the same behaviors. Figure 2 reveals a gap of four percentage points on the low-end (Trainee 7) and as great as 33 percentage points difference on the high-end (Trainee 2). While further inquiry is required to understand *why* the supervisors scored the performance higher than the knowledge workers, the evidence of this case study is sufficient to determine that the trainees in this case were given inaccurate data related to their job performance.

4.2 Supervisor Performance

Starting with the *data* component again, the Behavior Engineering Model guides us to evaluate if the supervisors know how well they were performing (e.g., training the new flight attendants) against a clear description of expected performance. Within the company, supervisors receive three opportunities to understand expected performance during the flight observation:

1) Supervisors experienced their own post-training flight observation
2) Supervisors see a copy of the performance measurement checklist annually
3) Supervisors receive the performance measurement checklist when a trainee boards the aircraft for the trainee’s operating experience

The three opportunities for supervisors to learn how to provide feedback are insufficient as demonstrated by their inaccurate reporting. These supervisors do not have a clear understanding of how their job performance compares to company performance expectations. Learning the expectations while performing the duties as designed in this training environment of the supervisor is not sufficient without a feedback loop where supervisors receive communication about the accuracy of their performance.

The process of testing performance using the BEM suggests testing each cell of the model in sequence. When a breakdown is identified in any step of the sequence, Gilbert suggests managers correct the component before further evaluation is completed (1978). As such, this study paused inquiry until the first component *data* is corrected, starting with providing data to the supervisor which may improve data reported to the trainee.

5 CONCLUSION

The Behavior Engineering Model was used as a tool to diagnose performance deficits in a knowledge management system. Gilbert suggests the first step in this sequence is evaluating whether the employee is aware of their performance compared to the expectations set forth by the organization. Direct observation and accuracy checks revealed that flight-attendant supervisors were inaccurately reporting trainee performance. This is a training concern as all of the trainees were given higher scores by a supervisor than by a knowledge worker. This is also a safety concern as the function of a flight attendant on a commercial airline flight is to conduct in-flight activities to ensure the safety and comfort of passengers. If new flight attendants are not accurately performing activities set forth by regulatory bodies (e.g., the FAA) many lives are at risk.

Diving deeper, the analysis was shifted to the performance of the supervisors. Starting back at the first step in performance diagnostics, we evaluated whether the supervisors were aware of their performance compared to the expectations set forth by the organization. Supervisors were not provided proper training in alignment with andragogy, which was a recommendation to the company as a step towards improving knowledge transfer.

The recommendation was made to the airline to improve supervisor training resulting in supervisors meeting job expectations and providing accurate feedback to trainees. The next step for the airline is to modify the knowledge management system to provide accurate *data* focusing on expectations and feedback, the inquiry into the flight observation. Upon making this modification, the airline may continue to analyze the training environment for flight attendants utilizing the framework of the Behavior Engineering Model.

The training environment is a common context for evaluating effective knowledge transfer. There is information the organization would like a new hire to know and apply to be proficient in their new role. The best way to assess if knowledge was effectively transferred is to observe the work activities of the new hire. Effective knowledge transfer can be evaluated using Gilbert's Behavior Engineering Model, a comprehensive analysis of worker performance.

Furthermore, the Behavior Engineering Model can be used to assess the efficacy of any knowledge management system. The efficacy of a knowledge management system can be evaluated in the subsequent behaviors of the users. The BEM provides a relevant framework for practitioners as they work to ensure knowledge transfer becomes behavior change.

Future Research. As this specific knowledge system is designed, the supervisors complete the performance evaluation as an *anonymous* performance checklist and return the results to the organization. Which begs the question, why are they reporting inaccurate performance data? That is, when the trainee data are reported back to the organization, the trainees do not receive a copy of their performance evaluation. An exception to the anonymity is when a trainee learns they scored low on the evaluation; even in this case, the trainee does not receive a copy of the evaluation. Additional work is required in this training setting to evaluate if performance feedback to the *supervisors* is sufficient enough to encourage accurate trainee reporting.

This case study provides a contemporary context for using the Behavior Engineering Model to troubleshooting a performance deficit in the training environment. Additional research applying the BEM in the training environment is required to continue to support this model's utility.

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