Feedback: How Does It Impact Software Engineers?

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***Abstract* – Feedback happens all the time in software development environments, but little is known about the impact it has. Motivation theory identifies feedback as an important factor, but doesn't consider the impact of different feedback characteristics. We present the results of a scenario-based study with 16 software engineers. Our study suggests that positive feedback has an impact on job satisfaction while negative feedback impacts behaviour. Motivation and productivity were found to be linked in just 20% of positive feedback scenarios.**

Keywords-component; Feedback; Motivation; Software Development; Professional Software Engineers

I. INTRODUCTION

Motivation is reported as one of the most frequently cited causes of an unsuccessful software project [5]. The real cost of dealing with unmotivated software engineers can be as much as 60% of a projects budget [1].

Several motivation theories suggest that feedback is an important factor in motivation by providing information on performance or on the results of one's actions.

In 1984, Cheney wrote that programmers "need feedback both for guidance and to satisfy their psychological needs with regard to performance. If they do not obtain this from their direct supervisors their productivity and satisfaction will suffer" [4]. Zawacki concluded from his research investigating motivation in IS personnel that "feedback from managers is the most important need of IS professionals" [13]. Zawacki's research was reinforced over 10 years later when Carayon found that "the most consistent predictor of job satisfaction is feedback" [2] while analysing questionnaire data collected from 1999 to 2001.

More recently in 2008 Chen concluded that "Jobs with the features of feedback, professionalism and autonomy can most easily increase the job satisfaction of IS personnel"; [3] and in 2007 Kim and Wright found that "Performance feedback had important indirect effects on work exhaustion by increasing role clarity and perceived advancement opportunities." [8]

While this research provides insights into the impact of feedback, it does not attempt to identify important characteristics of feedback and the impact specific characteristics may have.

In section II we present the literature on motivation theory. In section III we present the research method. In section IV we present the results. Finally, in section V we present the limitations, discuss the conclusions in section VI, and identify future work in section VII.

II. MOTIVATION THEORY

Four motivation theories identify feedback as a factor either directly or indirectly (through praise or recognition): Job Characteristics Theory, Goal Setting Theory, Hygiene Theory, and McClelland's Theory of Needs.

A. Job Characteristics Theory

Job Characteristics Theory was first published by Hackman and Oldham in 1976 [6] and was supported by empirical evidence. Feedback is included in this theory as an important factor that when present can lead to the individual experiencing a psychological state of knowledge of actual results. The theory argues that this psychological state, combined with other psychological states will lead to desirable personal and work outcomes, including high satisfaction with work, high quality work, and high internal work motivation.

Hackman and Oldham defined feedback as "The degree to which carrying out the work activities required by the job results in the individual obtaining direct and clear information about the effectiveness of his or her performance" [6]. This provides a basic definition of feedback but doesn't identify or discuss any of the characteristics of feedback.

B. Goal Setting Theory

Goal Setting Theory was first published in 1968 by Locke [9]. The theory argues that people are motivated to successfully complete challenging goals.

Locke identified 6 incentives that influence goals, including knowledge of score (feedback) and praise and reproof. Praise was found to improve performance, and reproof was found to improve performance if the feedback was related to a standard. Knowledge of score (feedback) was found to assist in motivation if the feedback was considered valid. To be considered valid the feedback must be received from someone whom the individual believes is in a position to give the feedback.

Goal setting theory identifies feedback directly, but does not define feedback. Feedback is discussed as a method to provide the individual with the knowledge of achieving a goal. The only characteristic of feedback discussed in goal setting theory is that of validity. The feedback must be considered valid by the person receiving the feedback. For the feedback to be considered valid it must be received from a person whom the receiver perceives to be in a valid position to give feedback.

Table 1. Characteristics of Scenario Questions

CHARACTERISTIC	SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4	SCENARIO 5	SCENARIO 6	SCENARIO 7
Type:	Positive	Negative	Positive	Negative	Positive	Negative	Positive
Timeliness:	Instant	Delayed	Delayed	Delayed	Delayed	Delayed	Delayed
Medium:	Face to face	Face to face	Email	Face to face	Overheard	Face to face	Face to face
Source:	Peer	Project Manager	Division Head	Peer Through PM	Peer	Peer	Project Manager
Subject:	Help with problem	Project Progress	Performance	Problem with Work	Help with problem	Breaking build	Recent Performance
Setting:	Casual	Stand-up Meeting	N/A	One-to-one Meeting	Casual	Casual	One-to-one Meeting

C. *Hygiene Theory*

Herzberg's Hygiene Theory was first published in 1959 [7] and argues that the factors which are most important in providing job satisfaction (*motivators*) are not the same as factors which avoid job dissatisfaction (*hygiene factors*).

Feedback of the results of one's work and praise were two aspects considered to be included in recognition, which was identified as the second strongest motivator factor. Hygiene Theory does not identify or discuss any of the characteristics of feedback.

D. *McClelland's Theory of Needs*

McClelland's theory of needs was first published in 1961 [10] and suggests that each individual has 3 core needs: need for achievement (nAch), need for affiliation (nAff), need for power (nPow). McClelland identified unambiguous feedback on the results of one's actions as one of the three defining characteristics of an achievement-oriented activity.

McClelland's theory of needs identified the difference between 'performance feedback' and 'affiliation feedback'. This theory argues that individuals with high nAch will have a stronger need for performance feedback, and individuals with a high nAff will have a stronger need for affiliation feedback. The theory does not go into any further details on the characteristics of feedback and what impact different characteristics may have.

III. RESEARCH METHOD

The data presented in this study was collected through individual responses from 16 software practitioners to seven scenario-based questions. The different characteristics of each scenario are listed in table 1. The scenarios chosen were based upon data collected during previous research [11, 12].

A. *Participant Introduction*

The participants received by email a brief introduction to this research and information on all of the 'people' used in the scenarios. It was made clear that these were fictitious people; but their role description would be similar to someone they work with.

B. *Scenarios*

The participants were sent the scenarios by email and were asked to reflect and respond to each scenario by indicating if it had an impact on any of the following five factors; Attitude, Behaviour, Motivation, Productivity, and Job Satisfaction. They indicated the scenario had an impact on a factor by ticking the box adjacent to each factor. The seven scenarios are listed below:

1. You're working with Rick (Software Engineer) on a piece of code he's having trouble with. After helping him, he thanks you and tells you what a life saver you are.
2. At a stand up meeting, Tom (Project Manager) tells the team how he's disappointed with the current progress on part of the project. You feel responsible for this lack of progress.
3. You receive an email from Boris (Division Head) telling you what a brilliant job you've done lately and how he's impressed with your performance.
4. During a one to one meeting with Tom (Project Manager), he talks to you about a problem with your work on a recent project. You suspect Tom (Project Manager) is relaying feedback from Rick (Software Engineer).
5. Gary (Software Engineer) asks you to help him with a problem he's stuck on. After you help him he thanks you, and you overhear him telling Simon (Software Tester) what a great help you've been.
6. Simon (Software Tester) comes over to speak to you. He has some bad news – recent changes you made broke the system.
7. During a one to one meeting with Tom (Project Manager), he tells you how happy he is with your recent performance.

IV. RESULTS

The results of the participants' responses are shown in Figure 1. Overall the scenarios had an impact on the participant's attitude 46% of the time, behaviour 44% of the time, motivation 54% of the time, productivity 18% of the time, and job satisfaction 64% of the time.

Across all of the scenarios, attitude was impacted at least once for 13/16 participants, behaviour was impacted at least once for 16/16 participants, motivation was impacted at least once for 16/16 participants, productivity was impacted at least once for 10/16 participants, and job satisfaction was impacted at least once for 16/16 participants.

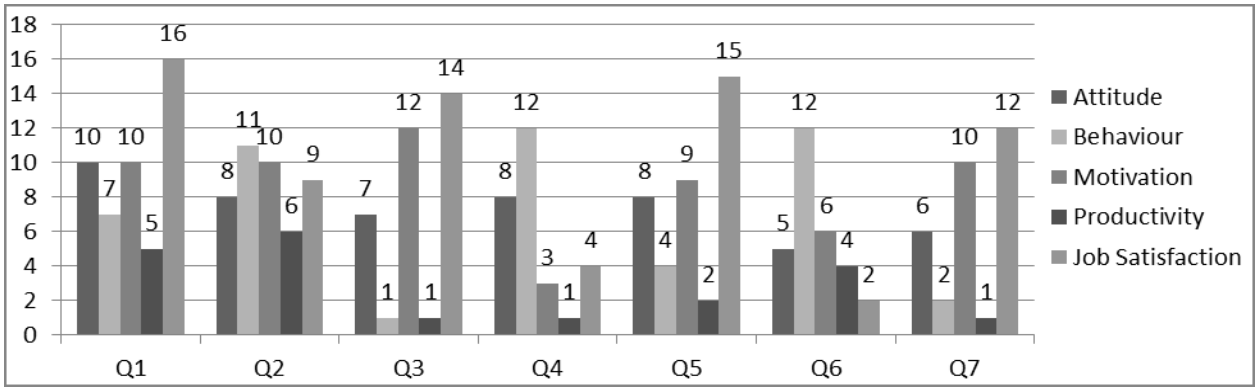

Figure 1. Collated participant responses to each scenario

Behaviour was impacted 22% (14/64) of the time in positive feedback scenarios and 73% (35/48) of the time in negative feedback scenarios. Motivation was impacted the least during scenario 4, where negative feedback was relayed from a peer through a project manager.

Productivity was impacted across all scenarios, but had the fewest unique participants reporting it as being impacted (10/16), and the fewest total occurrences (20/112). Job Satisfaction was impacted 31% (15/48) of the time in negative feedback scenarios, but was impacted 89% (57/64) of the time in positive feedback scenarios.

V. Limitations

The data presented was collected from 16 software engineers, limiting the representativeness of the results. All of the data was collected from one organisation, which allows for organisation-specific factors to influence the data.

The data collected was scenario-based, and while the scenarios were chosen with the aid of previous data collected from the same company, reading a scenario is not the same as the experience of receiving feedback.

VI. Conclusions

The data collected during this study offers some initial insights into the impact that the different characteristics of feedback may have, and suggests that motivation theory does not offer a complete picture of feedback and its impact.

Positive feedback was found to have an impact on job satisfaction in 89% of all occurrences. Negative feedback had an impact on behaviour in 73% of all occurrences.

The participants linked productivity with motivation in 20% of the positive feedback scenarios, indicating that these software engineers do not make the same connection as the literature that increased motivation increases productivity.

VII. Future Work

Future work will address some of the issues raised in the limitations by investigating feedback within a different organisation and an increased number of software engineers.

This study is one part of a larger study conducted at the same company, and future work will consolidate all of this research and compile a complete picture of the data collected from all of the participants.

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