Will They Report It? Ethical Attitude of Graduate Software Engineers in Reporting Bad News

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Abstract

Hiding critical information has resulted in disastrous failures of some major software projects. This paper investigates, using a subset of Keil's test, how graduates (70% of them with work experience) from different cultural backgrounds who are enrolled in a postgraduate course on global software development would handle negative information that is critical in a project. The subjects were mainly from Europe and Asia. The results showed that the subjects are highly likely to report critical information to their immediate supervisors ($t(36)=-11$, $p<0.0005$), but are undecided on whether they would take the matter further up the organisational hierarchy if the supervisor ignored their report. There was no significant difference between participants of different regions, or between those with and without work experience. The consequences of negative information not reaching the level where remedial actions can be taken could be serious in software projects. The results of this experiment point to the need to incorporate in software engineering curriculum the teaching of the ethical responsibility of effective communication of bad news.

1. Introduction

It is not uncommon for major software projects to fail because of key stakeholders withholding negative information. A prominent example is the failure of the CONFIRM project of early nineties, an ambitious travel reservation system combining hotel, airline and car-rental booking. It resulted in $125 million loss when the management team covered up major technical and performance problems and the auditors who discovered it did not speak out for fear of losing jobs [2].

When a team member has information that is critical of a project, it is often an ethical dilemma whether to hide it, perhaps in the hope that the project can be turned around, or report the negative information and possibly risk embarrassment or even loss of job. Failing to report negative information is called mum effect [3]. A related ethical issue is red lies [4] where project members make statements that are known to be false. In this paper, we study the attitude of computing graduates towards hiding negative information. The aim is to use the study as an exploration of how their education has influenced their ethical behaviour.

The risk of hiding negative information is exasperated by the growth in global software development including offshore outsourcing. Additional factors such as lack of face-to-face contact and cultural differences can make effective communication of negative information even more difficult in such cases. Several authors have reported related problems in offshore outsourcing environments. For example, Lacity and Rottman [5] discuss issues arising from cultural differences including reluctance to deliver bad news (e.g. missing deadlines) and suppliers wanting to please users resulting in over-commitments. Bhat, Gupta and Murthy [6]

identified language problems and organisational hierarchy as some of the issues affecting communication in global development. Carmel and Agarwal [7] put forward several strategies to reduce the cultural distance and thus improve communication in global development such as the appointment of a cultural liaison officer, an offshore-onshore bridgehead (i.e., the supplier stationing some of their staff on the client premises) etc. Similarly, Winkler, Dibbern and Heinzel [8] while studying the cultural gap between German and Indian companies have identified the unwillingness to say 'no' and differing expectations in handling criticism, among others, as common cultural themes in their case studies.

Computing education around the world has professional ethics as part of the curricula albeit at varying levels of emphasis (e.g. [9-13]). Of particular interest is the survey of Spradling et al. [14] which asked whether the curriculum included social and professional ethics; of the 251 institutions responded, 220 (i.e, 88%) answered positively. Similarly in a survey of 54 academics, Towell and Thompson [11] explored what the teachers considered as the important topics in ethics education. While these studies perform a vital part in understanding the nature and extend of ethics education in computer science curriculum, there seems to be not many research on assessing how effective the ethics education is in imparting ethical behaviour after the students have graduated. Such an exploration is necessary to help in determining the adequacy of the teaching of ethics. This paper contributes to this less explored area by conducting an experiment to assess an important ethical issue: whether computing graduates have learned the importance of not withholding bad news and whether they will convey critical news to the right authority.

Timely revealing of bad news is a problem. A deeper problem is revealing it at the right level where the information will be acted upon. A group leader or supervisor is not necessarily the level where the problem is rightly handled, especially if it arose at the group level and would reflect on the supervisor badly. *Therefore, it is important to find out whether individuals are willing to report the issue up the organizational hierarchy.*

In summary, the main aims of this research are to investigate the following questions.
- What is the attitude of graduates towards the reporting of bad news (a) with respect to hiding information? and (b) with respect to taking effort to ensure that it is acted upon?
- In answering the above questions, is there a statistically significant difference in responses between:
    a) graduates from three regions (Eastern Europe, Western Europe and Asia)?
    b) those with work experience and those without work experience?

2. Research method

The research method uses a significant part of Keil et al's [1] role playing experiment. In the experiment, a project scenario is given to participants where they take up the role of a project manager and are asked to respond to the scenario. The response is then statistically analysed. Keil's experiment involved four different scenarios measuring the effect of two factors (organisational climate and information asymmetry) on attitude towards delivering bad news whereas our aim was to measure only the attitude towards delivering bad news in an information asymmetrical situation and therefore we used only one scenario (Scenario 1 in Reference [15] Appendix). In this scenario, the participant was asked to play the role of a leader of software project Y. During the project, the leader *comes to know of a serious problem which if not rectified will have serious financial impact on the client down the track.* However, no one else is aware of the problem. Furthermore, nobody will know that the participant has this information unless he/she reveals it to others. This indicates information asymmetry which in turn means that the participant's response is not based on fear of the information anyway becoming public and thus potentially affecting his/her credibility. Hiding

> 1. *How likely are you to go directly to your supervisor to inform him/her of the system problems on Project Y?*
> 2. *If you inform your supervisor about the system problems on Project Y and he/she does not act to remedy the problem or inform the client, how likely are you to inform his/her supervisor about Project Y's problems?*
> 3. *If you inform your supervisor and his/her supervisor about the system problems on Project Y but neither acts to remedy the problem or inform the client, how likely are you to inform a senior executive about Project Y's problems?*

Figure 1. Items to measure willingness to report bad news, from Keil et al. [1]

or revealing the information will not affect the respondent's career prospects since he/she is moving to another job overseas with promotion. Based on this scenario, the respondent is asked questions to check whether they will reveal the information to the supervisor. This is a measure of their inclination to report bad news when there is no external pressure to do so. Two subsequent questions ask whether the respondent will take the case further up in the organisational hierarchy if the supervisor ignores the respondent's report. Answers to these questions measure the respondent's attitude towards taking effort to ensure that the negative information is acted upon. The items used to measure these two parameters are given in Figure 1. They were measured on a seven point Likert scale with following values: 1 for definitely yes, 2 for highly likely, 3 for likely, 4 for undecided, 5 for unlikely, 6 for highly unlikely and 7 for definitely not.

The participants were provided the scenario with the questions and were asked to provide their response anonymously. They had the option to withdraw from the exercise but all who were present participated.

2.1. Participants

The participants were graduates who were enrolled in a postgraduate course on global software development as part of a Masters program in Software Engineering. The course was organised by two universities: Mälardalen University in Sweden, and University of Zagreb in Croatia; the graduate students from these two universities participated in the course sharing lectures and projects using different means for communication such as Video Conference System, the Internet and web-based tools. The students from University of Zagreb were mostly from Croatia. The students from Mälardalen University were from different countries since the course belonged to an international masters program.

The data were collected from 37 participants. Around 30% were fresh graduates whereas 70% came with work experience. The country of the student was determined by their answer to the item: "the country where you lived most of your life". Figure 2 shows the demographics of the participants.

2.2. Statistical analysis

The responses were analysed using the statistical package, SPSS. A two-tailed one sample t-test was used to check whether there was a statistically significant difference between the mean response of the sample and the value for undecided. A two-tailed independent samples t-test was used to check for statistical significance between mean responses of those with and without work experience.

In order to check whether the geographic region of the respondent made a statistically significant difference in their mean responses, a one-way between groups ANOVA test was
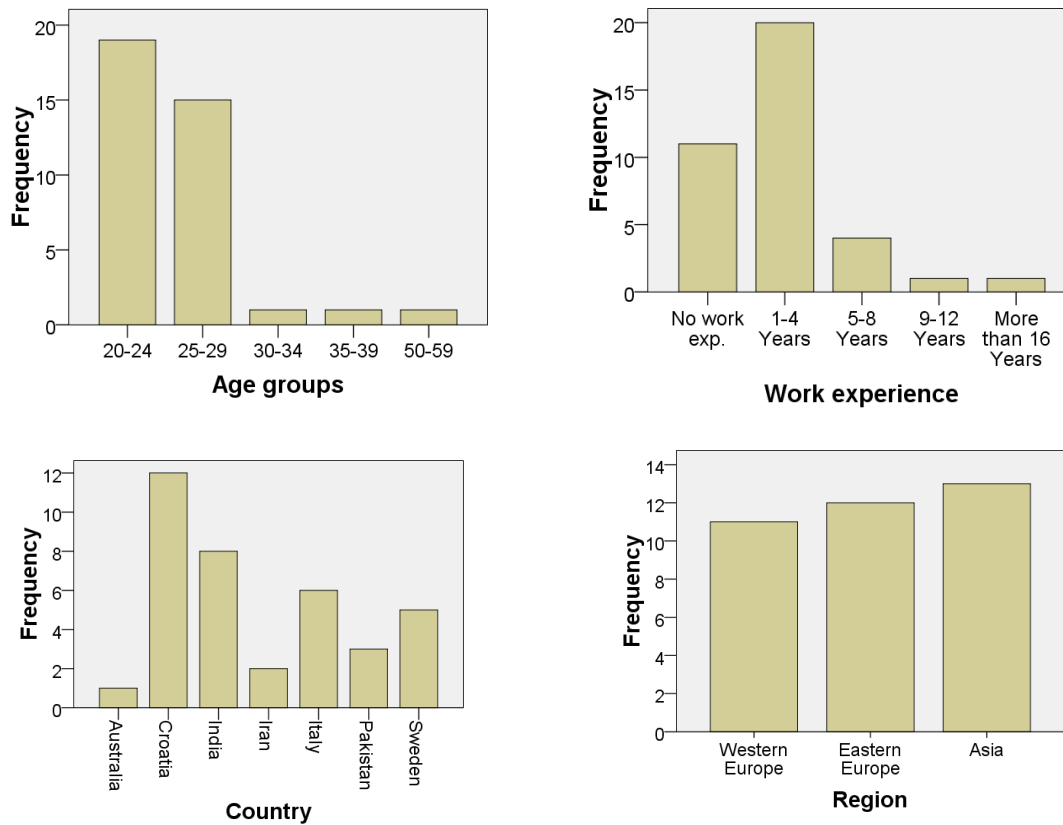
Figure 2. Demographics of the participants

used. The level of significance α was set at 0.05 for all tests. Levene's test for equality of variances was used to check that assumption for the t-tests and the ANOVA are satisfied [16].

3. Results

3.1. Attitude towards reporting bad news

First we considered all respondents together as a single cohort. Their mean (± std. error) for reporting bad news to the supervisor (Question 1 of Figure 1) was 2±0.18 where the scale ranges from 1 (meaning yes that they would definitely report the matter) to 7 (meaning a definite no). A two-tailed one sample t-test to measure the difference from the midpoint showed that the result was highly significant ($t(36) = -11$, $p < 0.0005$)

However, on the question of whether they would take the matter to higher authorities if the supervisor ignored their report (the average of responses to Questions 2 and 3 of Figure 1), the mean was 3.93 ± 0.28. A t-test confirmed that this was not significantly different to being neutral (($t(36)=-0.24$, $p=0.81$).

3.2. Differences between the three regional groups

Since the participants came from different regions, we investigated whether there were any significant differences between the responses from the different regions. Figure 3 shows the mean values (and 95% confidence interval) of the three regional groups (West European, East European and Asian) for the two dependent variables, namely, reporting to the supervisor and reporting to higher authorities. (The one case from Australia was not included in this analysis.)
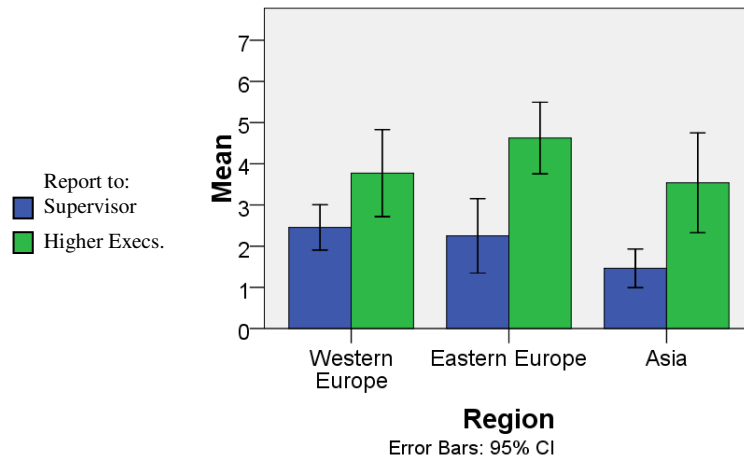
Figure 3. Mean values of the dependent variables for the three regional groups (1 means definitely yes, 4 means undecided and 7 means definitely no)

The ANOVA showed that there was no significant differences between the three group means for both the question of reporting bad news to their supervisor ($F(2,33)=3.08$, $p=.06$) and reporting the matter to higher authorities ($F(2,33)=1.41$, $p=0.26$); thus we couldn't find regional differences influencing the expected behaviour in conveying negative information.

3.3. Differences between those with and without work experience

In order to assess whether work experience had an influence in their attitude towards reporting negative information, we divided the sample into two groups: those with and without work experience. The differences in the mean values were not statistically significant both in the case of reporting to supervisors ($p=0.67$) and in the case of reporting to higher authorities ($p=0.3$). Once again we couldn't find work experience influencing the ethical behaviour.

4. Limitations

Ideally, we would like to measure the actual behaviour of graduates during a real ethical dilemma involving negative information. However, this is extremely difficult as are, as Kitchenham et al pointed out [17], organising controlled experiments in real software development. Role plays are used as a substitute in many disciplines such as Psychology to study social behaviour in such situations. A prominent and elaborate example of using role play is the Stanford Prison Experiment where college students were asked to play the role of prisoners and prison guards. The experiment revealed how situations could shape behaviour in ways that the psychology researchers found astonishing; the experiment had to be prematurely terminated because many of those playing the role of prisoners became seriously distressed [18].

Social desirability bias, that is participants responding in ways that are socially desirable, is another threat to role play experiments. Allowing subjects to remain anonymous has been recommended in such cases [19]. The reason is that if subject-anonymity is maintained there is no way to identify an individual's response and therefore there is less motivation for a participant to distort his/her answer to gain respectability. The responses in our experiment were anonymous thus reducing the social desirability bias. Besides, the participants'

differences in response to the two themes explored (reporting to the supervisor and reporting to higher authorities) is another indicator that the social desirability was not a major issue in the responses.

When student subjects are involved in an experiment, their responses can be unreliable if the experiment is part of an assignment that is graded[20]. In our case, this influence was also not there since the role play was voluntary and was not part of any assessment in the course.

Even though, the research reported here uses Keil et al's experiment which has already been validated in various studies involving participants from the United States, Singapore and South Korea [1, 15, 21], it is a focussed experiment and does not measure whether extraneous factors can change the attitude. For instance, Ramingwong and Sajeev[22] discuss communication gap, team solidarity and fear of consequences as three factors that could cause mum effect (i.e., withholding of negative information). The role play does not incorporate any of these factors except for information asymmetry which is related to communication gap.

We have used convenience sampling [23] which is acceptable in the initial observation and testing of a phenomenon. However, further elaborate studies are required to fully validate the outcomes. The generalisability of the results could also be affected by the fact that the number of countries represented in the sample from different regions is limited.

5. Related literature

The reluctance to report undesirable information was first studied by Rosen and Tesser [24] in Sociology. They found that people transmitted positive information much more quickly than negative information. A number of studies have investigated the phenomenon of mum effect in software project management (e.g. [2, 15, 21]). Tan et al [15] studied the effect of information asymmetry (i.e., the prospects of keeping bad news from becoming public) and organisational culture (i.e., whether reporting bad news is likely to be rewarded or punished) on mum effect using Singapore and the United States as two countries of cultural differences. They found that people from an individualistic culture such as the United States were more sensitive to the organisational climate in deciding whether to report bad news, whereas those from a collectivistic culture such as Singapore were more sensitive to information asymmetry in making the decision.

Keil et al [21] studied the influence of face saving opportunities on reporting bad news using data from South Korea and the United States. Their experiment showed that an opportunity to save face by shifting the blame significantly influenced the US subjects' willingness to report bad news; the influence was not statistically significant for the Korean subjects.

Sajeev and Ramingwong [25] analysed the influence of mum effect factors on IT professionals and IT students from Thailand. Their analysis showed that the risk of mum effect within the industry is less than what the general culture would otherwise indicate.

None of these researches, however, investigated the distinction between reluctance to hide information and willingness to ensure that the information is provided at the right level to take action. For instance, Keil et al. [1] used the three research questions of Figure 1 as one group and took the mean of the three answers to measure mum effect; on the contrary, we believe that there is a substantial difference between passing on information (whether positive or negative) to one's supervisor and going over the head of the supervisor to higher authorities. The first could almost always be expected as part of one's responsibility whereas the other requires more conviction and could be influenced even more by factors such as fear of consequences. Our argument is supported by the inter-item correlation matrix (Table 1) generated from the data where the correlation between responses to Questions 2 and 3 of

Figure 1 is a very strong 0.86, whereas the correlation between Questions 1 and 2 is a moderate 0.5 and that between Questions 1 and 3 is a weak 0.33.

Table 1. Inter-item correlation matrix for Figure 1

	Supervisor	Next Level	Higher executive
Supervisor	1.0	0.5	0.33
Next level	0.5	1.0	0.86
Higher executive	0.33	0.86	1.0

Furthermore, as far as we are aware, the work reported here is the first study on mum effect comparing samples from Western European, Eastern European and Asian cultures in the context of global software development.

Our focus was on studying the behaviour of graduates with a view of learning how ethics education had influenced them whereas the studies mentioned above were investigating issues such as the influence of cultural differences on ethical behaviour.

Berry and Berenbach [20] organised an experiment to measure the difference in ethicality of students before and after an ethics course. The course involved discussions of the ACM/IEEE Code of Ethics as well as other issues in ethics and case studies on ethical scenarios. Surprisingly, they found that there was no significant difference in the ethicality of students before and after the ethics course. This observation may be regarded as a case against ethics education, however, we do not believe so. Education and training are important ways to alter behaviour and thinking (for example, see[26]) and, degrees and certification are the ways in which people obtain their credentials[27].

Sindelar et al. [28] developed a measurement tool to evaluate students' abilities to recognise and handle ethical dilemmas. Students were given specific scenarios and their responses were scored based on several criteria including fairness and depth of analysis. The intention was to use it for pre- and post-testing of students' knowledge during a semester long ethics course; it is easy to see that this tool, however, has wider applicability. Lethbridge [29], with a focus similar to ours, conducted a survey of software professionals to find out the topics from their education that they considered relevant to the profession. He classified the topics into four groups: mathematics, software, hardware and miscellaneous. Ethics was included in the miscellaneous section. (Incidentally, ethics along with technical writing in that section were rated highly by the respondents.) Our work, on the other hand, is a focussed experiment to test, using a role play, the subjects' responses to a specific ethical dilemma; the two approaches are different but complementary and essential in understanding the usefulness and limits of ethics training that students receive.

6. Analysis and discussion

Ethics education is generally part of the computing curriculum globally. However, there have not been many experiments to measure how graduates would respond in an ethically challenging situation. Team members' withholding of negative information on software projects is such a situation which can have disastrous consequences.

We investigated the attitude of graduates from three different regions (Eastern Europe, Western Europe and Asia) towards reporting negative information.

We used a subset of Keil's role-playing scenarios. We considered this appropriate for our investigation because: (1) scenarios are also used in other established disciplines for evaluation of ethical behavior; for instance, Goldie et al. [30] evaluated medical students' ethical attitude to whistle blowing using case scenarios, (2) scenarios of Keil have been used

to study mum effect response in different IT populations (e.g. [15, 21]) and (3) the scenario we used presented a realistic mum-effect problem in an information asymmetrical situation to participants.

The results show that the average participant in the experiment is highly likely to report bad news to his/her supervisor in a situation represented by the scenario provided. This behaviour is irrespective of the region they come from or their work experience, thus indicating their prior education rather than work experience or origins instilling this behaviour.

However, a worrying observation from the results is that the graduates were undecided on whether they would take the matter further up the hierarchy if their supervisor ignored their report. This clearly indicates a possibility that critical information may not reach the right level where specific action could be taken to avoid disasters. Work experience or geographic origins of the respondents did not affect this attitude.

To summarise, the answers to our research questions are:

What is the attitude of graduates towards the reporting of bad news:

a)   *with respect to hiding information*

We found that taken together, the group is inclined to report any negative information to the supervisor. This result is statistically significant which means that there is a high probability that this behaviour would be evident in the population represented by the subjects. This is a positive result which shows that graduates understand the ethical principle of not hiding information critical to a project.

b)   *with respect to taking effort to ensure that it is acted upon?*

The mean response was neutral. This indicates that their ethics is not strong enough to ensure that negative information will be acted upon. It clearly indicates a need in ethics education to not just teach what is right and wrong, but to teach what the appropriate action in a situation is and how important it is to ensure that the action is undertaken.

In answering the above questions, is there a statistically significant difference in responses between:

a)   *graduates from three regions (Eastern Europe, Western Europe and Asia)?*

Even though there were differences in the mean responses from the three regions (See Figure 3), the differences were not statistically significant. Therefore, there is no reason to believe that the ethics education in the three regions has variations with respect to the questions explored.

b)   *those with work experience and those without work experience?*

There was no statistically significant difference between the mean responses of those with and without work experience. This was a surprising result since one would expect that compared to fresh graduates, those with work experience have better awareness and experience of ethical issues. This result seems to indicate that the ethical training largely comes from the subject's upbringing and education and does not change significantly with work experience.

Even though, willingness to report bad news to one's supervisor is a desirable mind-set, it is inadequate if the supervisor ignores the report. In a survey on ethics education in software engineering curriculum, only 11% of the academics who responded considered whistle-blowing as critical [11] indicating the low priority given to this aspect of ethics in the curriculum. Results of our experiment point to a need to change this low priority in ethics curriculum and to include proper training for dissipation of project related bad news to the right level in the organisational hierarchy where the information will be acted upon. Ethics curricula need to include prominent cases of mum-effect in IT projects such as the one

reported in [2] and discussions on how proper behavior in such situations would be consistent with a software engineer's code of ethics. In addition, educators need to develop cases involving ethical dilemmas of whistle blowing and use them as exercises in lectures. Cases from other engineering disciplines can provide models for devising scenarios suitable for software engineers. Herkert [31] provides a good discourse of ethics education in engineering. He quotes a video case study from environmental engineering where an engineer discovers that his company is causing environmental pollution; the ethical dilemma is whether to speak out against this practice or keep mum and show loyalty to the company [32]. Role playing [11] is another tool that can let students inspect mum-effect dilemmas from various dimensions and explore ethical solutions. Finally, summative assessments to measure how much students have learned from theory lectures and practical exercises are also important.

Acknowledgements

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