Learning from industry-based mentoring in undergraduate group projects

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Abstract

Mentoring has been used in tertiary education to enhance teaching practices, however, the link to learning outcomes is not clear. The literature covers a diverse range of learning outcomes, from the retention of information, to the development of general skills such as social skills. In this study, the impact of involving external mentors in undergraduate student group projects was investigated using the students’ perspectives. Interview data were collected and analysed. Several themes were identified using Template Analysis, and are discussed in this article. Generally, students responded well to the mentoring activity, however, some groups treated mentors as leaders rather than advisors, limiting their ownership of the learning activity. A further risk identified by this study is that students can become reliant on the skills of the mentor rather than making an effort to develop their own.

Introduction

Mentoring is the process through which relationships between mentors and mentees are formed to provide both professional and personal benefits to mentees (Gannon & Maher, 2012; Kram & Ragins, 2007) and has been used in both business and educational settings. At universities, mentoring is used to train new teachers or as a means for professional development (Ambrosetti & Dekkers, 2010; Hudson, 2013; Nicholls, 2002; Parker-Katz & Bay, 2008; Sundli, 2007). In some cases, peer mentoring has been used, where interested students take on the role of counselor and advisor for other students (Colvin & Ashman, 2010). Finally, online mentoring or e-mentoring has been used to help students connect with industry professionals internationally (McCarthy, 2012).

Mentoring is a versatile teaching method, which has been used as a retention strategy for undergraduate students (Jacobi, 1991). Additionally, Jacobi (1991) argued that although there is much literature describing mentoring programmes, evaluation of their academic impact has given mixed results. Other studies have sought to evaluate mentoring programmes based on the emotions of students, for example, Gannon & Maher (2012) found that 74.3% of mentees in their study felt that the programme was a positive experience. We aim to contribute to the former discussion, that is, the effect mentoring has on learning outcomes.

This study examines the motivational effect and educational impact of introducing experienced professionals to an undergraduate subject as mentors. The mentors and students had four weeks of interaction before students needed to present their project to a panel of judges from industry. A student from each group was randomly chosen for an in-depth interview, the transcripts of which were examined through template analysis. Several themes are explored and reported in this article.
Background

Mentoring in university education

The process of mentoring has been used in the business domain much longer than in the education sector (Retallick & Pate, 2009). Academic researchers reported mentoring is a positive experience for undergraduate research students (Pita et al., 2013) and teacher education (Ambrosetti & Dekkers, 2010; Sundli, 2007). Others highlight that active participation is necessary for students to benefit from mentoring (Gannon & Maher, 2012). The literature covers a diverse range of learning outcomes, from the retention of information, as measured by GPA scores (Crisp & Cruz, 2009; Salinitri, 2005), to the development of general skills such as social skills (Jacobi, 1991). McCarthy (2012) explored how e-mentoring can assist in students’ career development. Others concentrated their studies in professional development for teachers (Hudson, 2013; Laverick, 2016).

Student Motivation

The interests, feelings and motivation of students are closely related to how they engage with subject content, and some studies (Colvin & Ashman, 2010; Hudson, 2013; McCarthy, 2012) suggest that mentoring programmes can be effective in generating positive interactions. Bye, Pushkar and Conway (2007) distinguish between intrinsically and extrinsically motivated students based on their level of interest. Attention, curiosity and concentration of students are all related to how much a student is motivated (Ainley, 2006). Their interest in learning can be further described as ‘positive activation, direction and knowledge seeking’ (Ainley, 2006, p. 396). Bye et al. (2007) point out that while extrinsically motivated students can be active in the classroom, they are more likely to ask procedural questions rather than questions that lead to a deeper understanding of the content.

Learning Outcomes

Ackoff (1999) contrasts knowledge and understanding by highlighting their function of answering how and why questions respectively. As learning outcomes in education literature, these are also known as procedural knowledge and conceptual understanding (e.g. Hodson, 1993). Ackoff (1999) notes that the use of experiential learning in acquiring knowledge constitutes training rather than education. With regards to science education, Hodson (1993) suggests that rather than emphasising procedural lab work, the curriculum ought to focus on keeping students active in a broader sense.

As Azevedo, Guthrie and Seibert (2004) demonstrate, a controlled setting allows for the measurement of changes in conceptual understanding. To do so, they coded student descriptions of the circulatory system as a 12-step gradient starting from simply “blood circulates” to progressively more sophisticated understanding of the circulatory system (p.97). On the other hand, Moore et al. (2013) argue that it is student’s fluency in translating between different representations of a concept that demonstrates the attainment of understanding. In the present study, students’ accounts of their interactions with mentors were examined for any evidence that the interaction contributed to the learning of subject-related skills or concepts.
Research Approach

The purpose of this study was to evaluate the efficacy of mentoring in undergraduate classes. To achieve this we used an observational approach. We examine the teaching approach, as used in our class, however, no additional changes were made to the class to accommodate the study. After the completion of the class, a sample of students was interviewed about their experiences with their mentors.

Class Setting

The mentoring programme was introduced to undergraduate students in the 8th week of an IT subject that introduces them to quality improvement concepts. Students choose their own topics within a given theme of ‘sustainable futures’. Individually they complete two assignments, first defining and finding evidence of a problem, then proposing a solution to the problem. Later on, students are grouped for the last assignment where they choose one of the group members’ solutions and prepare a final proposal.

The list of group projects was made available to industry professionals who chose a group of students to mentor. They interacted with students for 4 weeks before their final presentation. The interactions between students and mentors were unstructured, so as to expose the students to industry professionals naturally rather than having them act as de facto tutors.

Sample and Interviews

There were 14 groups of students in this particular semester. Following the semester, they were sent a request to participate in an interview for this study through a broadcast email. A follow up email was sent to student groups that had not responded. 10 out of 14 groups participated in the interview. The semi-structured interviews were conducted by the third-party interviewer, who was not involved in the class. Participants were asked open-ended questions about their interactions with the mentor and experience with the programme overall. Some degree of self-selection bias was anticipated, that is, participants would be more likely to have enjoyed the experience and present a favourable account. As such, direct questions like “What did you learn?” were avoided, instead allowing this information to be volunteered throughout the interviews. Approximately 20 minutes was taken for each interview. 7 out of 10 interviews took place face-to-face and the rest was over the phone. All the interviews were recorded and transcribed.

Template Analysis

Template Analysis (Brooks et al., 2015; King, 2004) is a versatile content analysis method and the present study makes use of several features of this approach. Template Analysis makes use of a priori codes, which may be based on ‘the academic literature, the researcher’s own personal experience, anecdotal and informal evidence, and exploratory research’ (King, 2004, p.259). The bulk of the initial codes for this study originated from the established literature. The study then used iterative coding, specifically three phases of coding the data in between which the template was discussed and revised. For example, we added “Student Attributes” as a top-level code after discovering numerous statements about student personal attributes that might influence their participation in the mentoring programme. Finally, while Template Analysis has no hard restrictions on the number of coding levels or overlapping themes, four levels was the natural limit in this study, based on the availability of data from which themes were identified.
Learning from industry-based mentoring in undergraduate group projects, Refereed paper.

We have intentionally avoided reporting the frequency of themes as this could be misleading. The themes were identified after the interviews and were not part of the questions, hence the absence of a specific theme in a response does not mean that it was not applicable to that interviewee.

Findings

Based on the extant literature on student motivation, learning outcomes and mentoring, three major themes were coded in the transcribed interviews data. ‘Student Attributes’ emerged during the coding process as clear antecedents that shaped interactions with mentors. The top two levels of the final thematic template are shown in Figure 1 below. All four levels are included in Appendix A.

This section presents the findings of the study. A selection of the themes is explained below and supported by data from the interviews. Numbers correspond to the codes in the model below, e.g. (1.1) for motivation as a student attributes. The underlined part of each quote corresponds to the code being illustrated. Note that not every one of these themes is included, for example, we felt that the mechanics of communicating with the mentors (2.1) did not reveal any novel findings.

Figure 1. Conceptual model of themes

Student Attributes

Students’ disposition and behaviours are an important theme to consider which seems to have some influence on the mentoring activity. Student attributes are examined with the following four sub-themes:

The experience with mentors was influenced by the varied levels of motivation (1.1) that students brought into the activity. As one respondent put it:

“…some group members are receptive to it… [they] obviously want to interact with the subject, [while] some are not interested in university.”

Predictably, students motivated by grades took a utilitarian approach to their interaction:

“We used [the mentor] for the draft. He came back with a few good points… We confirmed with the coordinator that they were sort of mark-applicable, and we did use a few of those.”

Similarly another remarked:

“We showed him the subject outline… [what] we need in order to get the marks and in order to be the best of the best.”

On the other hand, some students had a less than enthusiastic reaction to the activity:

“…it felt like you were being pressured into doing well, especially since in my group… there was a student who said he was only there to pass.”
It is clear that the level of students’ motivation was varied in the class and some of them were not prepared to engage with mentors.

For risk-averse (1.2) students, the introduction of a mentor was taken very positively:
   “I felt relieved a bit, because if we did something wrong, they would help us… It is not their assignment, but we knew that if something did go wrong, we could have a safety cushion of sorts.”
While the student expressed positive sentiments, this response raises questions about the impact of the activity on their self-reliance, which will be discussed in the next section.

Differences in how students manage their time (1.3) has an obvious effect on their ability to have productive interactions with a mentor:
   “Had we really been a little bit more organised… It was probably all done the night before by most people, so we didn’t get a chance to use [the mentor] there.”
This was however something students were well aware of:
   “I wouldn’t blame the mentor on that. That was definitely on my team being lazy and leaving things late.”
Even after the limits of mentor involvement were explained in the class, some students continued to exhibit poor time management.

One other student attribute to consider is their ownership of the learning process (1.4). The following account provides a good illustration of potential risks in this teaching method as well as the diversity in students’ level of ownership:
   “We spoke to another group and they were saying how their mentor is essentially doing the whole work for them and things like that. I’m like, It’s not really what a mentor should do, but obviously we didn’t say that… We were, ‘Oh, fantastic. Good for you.’ That kind of… gave us a little bit more incentive to work harder and try to be better than the others.”
This illustrates the difference in attitudes between students who want to do their own work while others are more than happy to take advantage of what they perceive as free help.

**Mentoring Process**

With regards to the process of mentoring, participants discussed their interaction with mentors, relationships developed with them, time commitments and the assistance they received.

The involvement of an external mentor is a positive experience for students, as evidenced by the quality of relationships (2.2) that developed over the short timeframe:
   “We were lucky to have our mentor… He was very friendly, he made us feel comfortable. He supported us when we needed.”
With regards to the learning outcomes however, at least one group fell into a dependent relationship (2.2.3) with their mentor:
   “… maybe too much reliance on the mentor… We would always go to them first instead of maybe trying to come up with our own solution.”
It would appear that the students in the latter example treated the mentor as a member of their group, suggesting the need for more clearly defined boundaries.
Students were cognisant of the value of mentors’ time (2.3.2), with several respondents expressing appreciation for it:

“They are giving up their time to help you. You should utilise that time well and not waste their time.”

A practical consideration in setting up the activity is finding mentors with available time (2.3.3). Some mentors were quite accessible for students:

“He was available for 24 hours for us. Not like in person but through email, internet contact, if we had any questions regarding that topic.”

Other mentors had limited time due to existing commitments:

“The first [meeting] was about 30 minutes, then he just went back to work… The second one was about an hour… unfortunately, he couldn’t push it any longer, because he had to go to work, which is understandable.”

Although there are natural differences in the levels of time committed by mentors, students were able to engage with those who were less available.

In addition to providing students with feedback on their work, some mentors took on de facto leadership roles (2.4.1) in the teams:

“I reckon if there was not a mentor involved, we would just be messing around, not really focusing on time. I think, not really organised. And then with a mentor we had guidance to push us to do things on time and correctly.”

This leadership dynamic was enabled by the performance expectations (2.2.2) felt by students:

“There is a sense of urgency in the work, because now there is someone who has expectations for you. Because if you turn up to this meeting and you have done nothing then it is not going to look good for you and your group, and that is motivation.”

In these examples, it is clear that the presence of mentors provided an impetus for students to complete their projects, however, they raise questions about the self-reliance of students, which we will revisit in the discussion section.

**Mentoring Outcomes**

The interviewees described a number of direct outcomes of their interactions with mentors, such as improving their skills in planning meetings or forming a networking relationship with their mentor.

A common outcome reported by the interviewees was a heightened level of motivation (3.1) towards the subject activities:

“A lot of time, when you’re getting it from the perspective of someone who only works in the university, it’s hard to really encourage yourself… when you see someone who can actually apply it to a real world situation, then it will encourage you to go ‘actually, this kind of work actually makes a difference, or is actually used in the real world.’, and so you get that level of enthusiasm.”

This motivation appears either to be related to a difference in the level of trust for the mentors and the university, or as another student put it, the grounded nature of interactions with the mentor:

“It’s definitely beneficial for us to take a lot of notes… everything that we’re being taught, is not fake. It will be utilised in the business world if you continue on that career path.”

Some students are energised by the interaction with industry professionals and appear to have become more engaged with their studies as a result.
The activity allowed for the development of some professional skills, such as planning meetings (3.2.1), which students either practiced, or in this case, reflected on the value of:

“There should have definitely been an agenda and a plan, but no, there wasn’t… ‘Oh, yeah, we’ll see him next week. We don’t really know what for.’... [In hindsight] I would have definitely tried to take the approach of being a little bit more professional.”

Here we can see how mentoring provides students with some preemptive exposure to professional interactions, while avoiding the negative consequences of their mistakes.

Several respondents noted the heightened performance expectations (3.6) due to the presence of mentors:

“It’s like there’s an expectation to deliver a certain level of work... it’s like giving us a textbook, and since we have that information, we’re required to use it and bring out a better product in the end.”

This effect appears to include otherwise disengaged students:

“There’s no disadvantage except, again, students might feel like they’re obligated to do well when they wanted to just cruise by the subject... when we had our mentors come in, I felt obligated to bring my own ideas, actually start completing tasks... It just made you feel responsible for the work that you were going to put in.”

These students felt additional pressure, but it was effective in prompting them to complete their reports / assignments.

**Cognitive Development**

This study evaluates the mentoring programme to see whether it has impacted on either the procedural knowledge or conceptual understanding of students.

Looking at mentoring as a teaching approach, we distinguish the achievement of learning goals specific to the subject from general professional development seen in the preceding section. With regards to procedural knowledge development, writing skills (4.1.2) benefited from the activity where mentors took on a tutoring role:

“We had some issues with our writing and title and he told us ‘do this and don’t do that, cut this and add that to make your presentation look better’”

For research skills (4.1.1) however, the introduction of mentors had a detrimental effect as some of their help reduced students’ own information search:

 “[The mentor helped in] finding us resources that we couldn’t have found ourselves.”

Others reported a similar “benefit”:

 “... especially for students who don’t really like the idea of going out of their way looking for that source of information.”

This unforeseen interaction between students and mentors was counter to a subject goal, that is, developing research skills.

While we had hoped that the mentoring activity would give students an extra opportunity to develop their conceptual understanding of subject content (4.2), the interviewees’ accounts suggest that the activity instead exacerbated students’ focus on submitting their report. One response however, suggests that it is possible for mentors to act as more than just a means of completing tasks:

“We used to have a board and writing marker. [The mentor] used to draw, kind of try to make us understand by drawing different diagrams.”

Although there is no indication of what understanding the students may have gained from that particular interaction, it represents an opportunity that will be examined in the discussion.
Discussion

Recalling Hodson’s (1993) suggestion that students learn better when they are active rather than passive, the activity was effective in generating engagement across the whole spectrum of students. Even students who felt like they were “being pressured into doing well” appeared to be more active than they would have been without a mentor, however, some regretted that their poor time management meant they “didn’t get a chance to use [the mentor]”. The reflection in the second example might be considered a necessary step in a student’s professional development, supporting the utility of mentoring in helping students’ transition to the job market (Gannon & Maher 2012).

While none of the respondents strongly objected to the extra pressure introduced by a mentor, given the ease of rationalising this as helping them to achieve better marks, a question remains of whether this pressure contributed to a positive outcome overall. An alternative interpretation would be that mentors took away students' opportunity to fail in their tasks. This is particularly clear in the case of students who relied on their mentor as a “safety cushion”. Crisp and Cruz (2009) state that mentees gain independence in the separation stage of the mentoring process, which would be consistent with our finding that a strong dependency can exist for some students in the preceding stages. This corroborates Colvin and Ashman's (2010) peer-mentoring study, which found that ‘Students who were dependent were seen as needing a babysitter [by their mentor]’ (p.129). However, we would like to see students develop self-reliance and internalised discipline, which the mentee dependency appears to hinder for the duration of the mentoring process.

The effect on students’ self-reliance may be related to the treatment of some mentors as de facto team leaders. As one student stated: “We would always go to [the mentor] first”. Similar to findings by Retallick and Pate (2009), our students saw mentors as a source of help and advice. Certainly, some mentors were very charismatic and experienced professionals that an undergraduate student might naturally defer to, consciously or not. Colvin and Ashman (2010) highlights that a common goal of peer-mentoring programmes is their development of the mentor’s leadership skills, however, there is no elaboration on how this affects the mentee’s behaviour and self-reliance. While our data here is limited, there is an opportunity for further research to examine the charisma of mentors and its influence on mentee development.

Unfortunately, some accounts of the mentoring activity suggest that it failed to deepen student understanding of subject content. However, there is evidence indicating that some students can be more receptive to sources outside of traditional teaching staff as the interaction with mentors helps some students to realise that “everything that [they]’re being taught, is not fake.” This suggests that there may be a benefit from preparing mentors ahead of their interaction with students, though this could blur the line between a mentor and a tutor.

Conclusion

As with any practice, the use of external mentors has advantages and disadvantages. Since it brings a novel element to teaching delivery, students respond very well. Even less-engaged students who might avoid other activities, tended to participate in the mentoring programme. The extra engagement however, is focused on the mentor themselves, who some students appear to consider as a group leader. The extra engagement might therefore be due to students following a highly-charismatic or experienced mentor rather than internally generated
motivation. Finally, our findings indicate that mentoring can have an adverse effect on education in some cases if students rely on the abilities of the mentor instead of taking ownership of their learning. It is not clear how the excitement generated by the novel activity itself can be translated into an interest in, and study of, the subject content.

Acknowledgement

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References


**Appendix A – Final thematic template**

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