

Changing the conception of teaching from teacher-centred to student-centred learning among engineering lecturers

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ABSTRACT: Engineering education has moved towards a student-centred learning (SCL) approach, which has been proven to be more effective when compared to the teacher-centred approach, especially for acquiring 21st Century skills. However, many engineering lecturers are reluctant to change their teaching paradigm and approach to SCL, although they have received training. This study aims to explore the factors that can change the conception of teaching among engineering lecturers. This phenomenological study followed two engineering lecturers for one semester through classroom observations and interviews at a university in Malaysia, after they underwent SCL training. The thematic analysis showed that both lecturers started with the teacher-centred paradigm before the training, due to their previous learning experience under the teacher-centred approach by their lecturers. After the training, they showed an inclination to adopt SCL in their classes. However, due to unsupportive colleagues and department, and poor management, one lecturer failed to make the transition. The other lecturer successfully embraced the SCL paradigm after she saw the positive impacts on her students, and her colleagues did not discourage her to change. This study demonstrated that the conception of teaching influenced the implementation of SCL, and the factors that bring successful change are training, support and appraisal.

Keywords: Student-centred learning, conception of teaching

INTRODUCTION

The advent of Industrie 4.0, as well as the challenges of the 21st Century require engineering lecturers who can develop competent engineering graduates with 21st Century attributes and skills [1][2]. This mainly calls for the student-centred learning (SCL) approach, as opposed to the teacher-centred approach [3-6]. Studies have shown that the acceptance of SCL implementation among students and lecturers in engineering has had a positive impact on improving lecturers' teaching [7]. Unfortunately, most engineering lecturers tend to utilise teacher-centred approaches [8][9]. Although they have positive perception of SCL after attending training, many felt it difficult to change their teaching paradigm to SCL [10]. One of the major reasons engineering instructors held a teacher-centred teaching paradigm is the predominantly teacher-centred culture in the engineering learning experience, which is expected, because individual learning experiences shaped their conception of teaching [11-13].

There is little literature on engineering lecturers' transition to new conception of teaching. Generally, the studies discussed changes in knowledge, beliefs, attitudes, understanding, self-awareness and teaching practice [14-16], but not the factors that influence the change. Engineering lecturers can implement the SCL approach successfully, if they believe they can change. Lecturers need to understand how they think, i.e. their perceptions about teaching [17]. The conception of teaching can be defined as specific meanings and interpretations lecturers use to describe their teaching, which guides them as they make teaching decisions, actions and behaviours [17]. During the transition, engineering lecturers had to go through several phases to change their conception of teaching [13]. Appropriate support can help to make the transition successful. However, engineering lecturers have found it difficult to accept SCL, because of internal and external problems [18-20]. With the complexity of engineering content, lecturers need to be creative and dynamic to implement SCL successfully. Institutions of higher learning normally organise training courses in SCL for lecturers [21]. The effectiveness of these courses is related to changes of conception of teaching [22], but the change of teaching beliefs requires time [23]. To help and support the engineering lecturers in changing their conception of teaching, factors on how change can happen are studied and presented in this article.

RESEARCH METHODOLOGY

Phenomenological research methodology is used to study the change of conception of teaching from teacher-centred to SCL and factors that enable or disable the change [24]. Phenomenology is a type of research design that focuses on

understanding and interpreting profound human experiences [25]. Through the detailed interpretive process, the in-depth description of an interpretation of the phenomenon, such as the hermeneutic cycle is generated. Suitable research methods to study experiences are observation and in-depth interview. Two engineering lecturers from a university in Malaysia were selected as the respondents, because they: 1) teach engineering courses; 2) are new to implementing SCL; 3) attended SCL training; and 4) are highly interested in implementing SCL. Designated as Arthur and Betty, each had three interview sessions, and 28 observations were carried out in every class over one semester. Data were transcribed and analysed using thematic analysis. This method is used to analyse, identify and report patterns within data to describe people's experience across the data [26].

Respondents' Background

Before this study, both respondents practised mainly the teacher-centred approach in their classes. However, Arthur was exposed to SCL at the beginning of his career through team teaching. Even though he did not know SCL at that time, he was mentored by an expert engineering lecturer to help him implement SCL successfully. In this study, he taught a fundamental engineering discipline course, which he had not taught before, to 25 second year students. Unlike Arthur, after 10 years of teaching, Betty had no idea about SCL until she attended SCL training. She tried several teaching techniques, like field visits, but most of the time, she used teacher-centred approaches. In this study, Betty taught a 3-credit hour elective engineering specialisation course to 20 final-year students.

FINDINGS

There are three important phases of the conception of teaching transition from a teacher-centred to an SCL paradigm: before SCL implementation, after attending SCL training and during SCL implementation. The moments are based on the points, when the respondents demonstrated change in teaching intentions, actions and beliefs. For example, many changes happened to the respondents after attending the training, like they developed new teaching intentions and a positive perception of SCL. Based on these changes, the moment after attending SCL training is designated as one of the phases in the conception of teaching transition. Phases of transformative learning were raised to explain how the changes occurred.

Before SCL Implementation

Arthur and Betty graduated from the same university in Malaysia. There are two similarities that caused them to hold on to the teacher-centred learning paradigm as their initial conception of teaching: educational background and epistemology. Their initial conception of teaching reflected the teaching approaches used by their previous lecturers that were highly teacher-centred. They basically teach as they were taught. To them, lectures and tutorials were synonymous with learning in engineering. Arthur said, *the thing that I remembered was...all lecturers used conventional approach, they just gave me lectures and tutorials*. The belief in knowledge or epistemology, is at the beginning of conception of teaching transition. The respondents used this belief as the reference to their initial teaching belief. For example, they reflected on their learning experiences, such as how to learn, learning methods, and what they did to understand difficult subjects. Arthur said, *...knowledge is about students' understanding on the contents for students to solve the problems*. Betty, meanwhile, stated, *..knowledge...is.. I think... about memorising skill where the students can remember what they learned so they can apply it*.

The quotes show their belief that knowledge is given by lecturers. The knowledge meant is at surface level, memorising course contents and some applications, illustrating the teacher-centred paradigm. This was ingrained since they were students, believing this is the best way to learn, influencing initial teaching actions. Their experience gave them an interpretation of the meaning of teaching and learning, forming their initial judgment and perception. When asked *What is teaching?*, Arthur said, *...Teaching is a process to deliver the information or any knowledge...this information should be delivered, so others can understand and get that knowledge... no matter what feedback we receive during that process, as long as they received and understood, that is called teaching, and if the students do not understand, that is like giving a talk*. When asked the same question, Betty said, *...ohhh...teaching is...ehm...I deliver the knowledge*.

After Attending SCL Training Workshops

Before the new semester began, Arthur and Betty attended two sessions of SCL training. The training consists of two phases: active learning and team-based learning. The training introduced and exposed the trainees to informal and formal cooperative learning and principles on effective learning techniques. It also included a variety of SCL teaching techniques and educational knowledge to support SCL implementation, such as the how people learn a framework [27] and constructive alignment [28]. The findings show that they have gained knowledge of teaching and learning, such as:

- a) knowledge on teaching and improvement of their teaching skills;
- b) assessment;
- c) solutions to handle teaching problems;
- d) teaching techniques.

The training workshops enhanced their awareness of effective teaching through SCL. They felt that their initial teacher-centred paradigms were no longer relevant to be practised. Through the training sessions, they were aware of the

meaning of effective teaching, which became a starting point to change to a new teaching perception towards SCL. Betty said *...to change the teaching perspective, style or approaches depends on the initiative of the lecturer and no compulsion by others or institution.*

If the lecturer realised the need to improve their teaching and the importance of producing high quality engineering graduates, the lecturer should participate in any teaching and learning training, such as this SCL training. In Arthur's case, after attending this training, he realised that the student-centred strategies were suitable for solving his teaching problems. Thus, based on the knowledge gained from the training, he applied them, and the problems were solved. The respondents made the comparison between their previous teaching practices with the SCL techniques. Exposure to SCL gave them ideas to change their practices besides the teaching perspective.

Implementation of SCL

Arthur: New Conception of Teaching

Arthur started the semester with the intention of implementing SCL in his class. The training gave him ideas to improve his teaching. The feedback from his students and the effectiveness of SCL changed his teaching perception about SCL. Thus, in the new semester, he intended to implement SCL techniques to teach more effectively. However, Arthur did not have proper teaching strategies and plans, especially on the selection of SCL approaches. He said, *...Usually I had discussions with other colleagues and the programme coordinator to discuss the course outline, the objectives, expectations and assessment. In terms of the content, I read and asked the previous lecturers who taught the course for their power point slides, so I could study them, change a little bit of the content depending on myself. In term of SCL techniques, I did not plan yet. I know, supposedly I should have it now.*

Arthur faced the problem on mastery of the course contents although it was a fundamental course. He needed some time to familiarise and gain understanding. This semester was his first time to teach this course. He said that he just wanted to focus on the content rather than teaching strategies. That challenged his new teaching intention to implement SCL. He said *...I think that this semester I have a problem familiarising myself with the new teaching content. This is my first time I have taught this subject. I spent a lot of time to understand the content.*

Arthur expressed his frustration about teaching using SCL. He knew he should focus both on the content and teaching strategies, but chose to concentrate on the content. He said, *...the implementation and strategies of SCL approach, everything is in my head. Yes, they should be planned, but I do not plan yet.* The absence of a proper teaching plan in a new course challenged his new teaching intention. He said, *...the students did the presentation and now the part of calculation, I know SCL techniques, such as team games tournament, but it takes time, so I do not think that technique can be applied.* Arthur faced a conflict: continue his intention to implement SCL or retain the conventional approach.

At this moment, he needed support. He tried to seek support from his department and colleagues, but received the opposite signal, *...in this year, majority of lecturers decline to teach that subject using PBL. But, when the coordinator withdrew from teaching that subject using PBL, the lecturers who initially declined to use PBL volunteer to teach that subject.* His department also has no support programme to transform teaching. His colleagues did not support him to transform his teaching too; they even resisted the implementation of SCL, because most of them had a clear centrality of teacher-centred belief. As a junior lecturer, he wanted to feel safe; so, he decided not to feel alienated among his colleagues. That forced him to return to the teacher-centred learning paradigm. Thus, he used his previous experience to fit the unfamiliar content, which gave him comfort in teaching.

Betty: New Conception of Teaching

Betty started at the same point as Arthur in SCL implementation. She had a new intention to implement the SCL in her class. Similar to Arthur, she felt motivated to implement what she learned in the training. She said, *...Ok! The lecturer and students can exchange ideas and knowledge on the content...that is my intention to make the learning process more interactive and ...The second is I want to make sure the learning environment is an exchange of ideas or knowledge between the lecturer and students.* Betty imagined the social learning environment and saw her role as a facilitator. She felt ashamed when she was not well-prepared in the first class. Before this, Arthur and Betty did not have teaching plans, and she only prepared materials and notes to teach. Both respondents noticed that SCL implementation requires proper teaching plans to achieve the learning objective. An improper teaching plan will cause problems, such as bad time management, insufficient students' engagement in the learning process, unclear instructions, and many more.

However, Betty faced a dilemma when her belief in teacher-centred learning paradigm contradicted her new teaching intentions and actions. She thought active learning did not help students to learn. She wanted to lecture and was worried whether the students would be able to construct their own understanding. She assumed her students had negative perception towards her teaching and underestimated the capability of students in constructing knowledge. These negative perceptions arose from her previous experience and conventional epistemology. However, towards the end of the semester, she changed her mind after several implementations of SCL. She realised the SCL implementation

was easy and helped her to get to know her students' understanding of the topic before the final examination. The students were increasingly motivated and interested to join the activities; even the shy and quiet ones became talkative. The learning environment became warm, and students had the confidence to question and interact between themselves and with Betty.

Like Arthur, she faced the same teaching problems and resisting factors. Betty used her teaching experience to encourage students to engage with the SCL activities. In addition, Betty had a supportive environment to help her implement SCL. There is no resistance from her department and colleagues, and the course learning outcomes for her programme had been formulated to support SCL environment. Betty admitted the effectiveness of SCL in students' development and the quality of teaching. She said, *...Before this I only knew and used lecture, and I never thought to change my lecture style, but after I tried SCL activities, it gave me opportunities to find weaknesses of my teaching style and that led me to improve ...SCL are not just for students, but it also benefits the lecturer.* Actually, the implementation of SCL techniques is an initiative of the lecturer to change their conception of teaching ...also to meet the industry requirements.

DISCUSSION

The findings show factors that determine the success of the conception of teaching change and implementation of SCL. Both Betty and Arthur have similar backgrounds and were motivated to implement SCL after the training workshop. Nevertheless, they ended up with different experiences and outcomes at the end of the semester. Arthur's previous experiences influenced him and overshadowed the new teaching experiences that he gained from the training.

This strong and clear belief in learning made him decided that the priority for this semester was on content, rather than integrating it with the SCL techniques. So, Arthur's new teaching intentions changed to: 1) focus on mastering the subject content; 2) focus on delivering the content; and 3) leave out the implementation of SCL techniques.

In terms of his teaching actions, he used the simplest SCL technique, such as think-pair-share as an intermittent activity during lectures. From the classroom observation, he applied think-pair share, jigsaw and peer teaching. He implemented mostly conventional teaching approaches like he did before the SCL training. Arthur could not sustain his new teaching actions and intentions until the end of the semester because of several resistance factors. The factors that made him revert to the teacher-centred paradigm were:

1. Focused on content, which is an essentially the teacher-centred paradigm. He said, *...but now (mid-semester), the topics are quite tough, so I prefer to do lectures.* Also, since this is his first time teaching the course, he wanted to focus on the content.
2. Prior teacher-centred learning experience. Arthur's educational environment was exposed to a highly teacher-centred educational environment. Those experiences form the initial judgment and perception on his meaning of teaching. He taught using the same teaching approach, which is the conventional teaching style.
3. Absence of a teaching plan to implement the SCL teaching strategies. To do SCL, planning is one of the most important parts to make sure the activities progress smoothly and effectively. He also had problems with managing his time.
4. Difficult to get students to cooperate, while doing the activities. He said, *...waiting and keep waiting for the students' response, if I am doing activities. If I still want to do activities, sure I can but...my students are not active to participate in the activity and it takes a long time to wait for their response.*
5. Resistance from colleagues. His colleagues did not support him in transforming his teaching concept, they even resisted the application of SCL in their faculty. Most of his colleagues had a clear view of the centrality of the teacher-centred approach as their teaching belief.

At the end of the study, even though he had high intention and motivation at the beginning to implement and change to SCL, he could not sustain his intention until the end of the semester in the face of discouraging colleagues. During that period, without any support, his intention was diverted. The training changed his teaching perception, awareness, practices and intentions, but it was insufficient to change his teaching beliefs.

Betty successfully changed her conception of teaching from teacher-centred to SCL. After a semester, she enjoyed implementing SCL and intended to sustain the techniques the following semester. Betty also faced difficulties to change to the SCL paradigm and she used her new teaching perception and intention to counter these problems. The factors that helped Betty change her conception of teaching towards the SCL paradigm were:

1. Positive feedback from students. *I received two comments from students, first, he/she said thank you and second said I really enjoy your class, because you did a lot of activities. The students gave full attention and participate in every activity. I can see their happiness and excitement when they do the activity; ...they have the initiative to find*

their own learning materials...the most I remember is they enjoy on the moment while they are doing that activity...;

2. Belief in the SCL paradigm to produce better engineering education. *I realised when I did a class discussion on physical, chemical and biological characteristics, it had a big impact on my students, when they did that activity...they can answer my questions (laugh), because they remember what they did at that time. Every student gives full attention to the presentation and was excited to present their work and show the findings;*
3. Achieved her new ultimate teaching goals to develop SCL environment and teaching satisfaction. *...doing SCL gave the opportunities and ideas to improve my teaching;*
4. Supportive colleagues who implement SCL. *The implementation of SCL is depending on faculty. In my Faculty, it is not compulsory for lecturers to implement it, it is own initiative to make change in the teaching.* The course learning outcomes in her department also encourage the implementation of SCL.

At the end, the respondents held different teaching beliefs on defining the meaning of teaching and learning. Several factors influenced the transition of conception of teaching and the implementation of SCL, which determined the outcome in changing the teaching paradigm from teacher-centred to student-centred as seen in the two respondents. Betty, who changed her conception of teaching to the student-centred paradigm, represents a successful transition with new changes of conception of teaching. Arthur's unchanged belief on teaching is reflected in his implementation efforts even though Arthur and Betty had the same learner experience before the training. The findings were that the respondents' backgrounds formed the initial conception of teaching and influence the transition change in conception of teaching as asserted in previous research [29]. According to adult learning theories, previous experiences reflect on common teaching practices [30-32].

Early exposure to an SCL environment can result in an inclination towards the SCL paradigm in the initial interpretation, assumption and justification of the meaning of teaching [11]. In addition to the background and the initial teaching beliefs of both respondents, there are also factors during SCL implementation that influence the conception of teaching transition. One of factors identified here is the effort made to change, such as having a clear goal and proper plan for teaching. Supportive surroundings, especially colleagues' perceptions about SCL is also important. It is also important to note that SCL belief did not change immediately upon the successful SCL implementation. It took Betty several lessons and seeing the impact on her students before she finally embraced SCL.

The transition seen in this study is in accordance with the transformative learning theory [13]. The sociocultural factors addressed in this study is the background context inclusive of related historical influences experienced as students. The personal contextual factors are referred to as a readiness for change or a predisposition for a transformative experience. This study shows the readiness of respondents to change their conception of teaching to SCL paradigm by the transformation phases they had after attending the SCL training and the effort they have shown, while implementing SCL even though they did not have the proper support system. More importantly, the transition of conception of teaching from a teacher-centred to a student-centred paradigm does not only depend on lecturers, but it involves many roles, such as colleagues and the department or institution.

CONCLUSIONS

The change in conception of teaching can occur among engineering lecturers. However, it is related to the individuals' previous experiences and the continuous support they receive during the transition. Few studies have focused on the transition process during this change, but some of the studies [33-34] found the connection between the successful transition of conception of teaching with the support system or staff developmental programme. This study found that the change of conception of teaching to the SCL paradigm can occur among engineering lecturers, by taking into account the significant factors. By understanding the factors, it enables new implementers of SCL to obtain help through the transition phases, especially in the Malaysian context.

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