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Exploring Question Posing-based Learning Teaching Strategy: SQDL

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Abstract: A self-directed learner takes ownership of their learning journey and actively drives their learning process. Becoming a self-directed learner requires acquiring knowledge, skills, and attitudes in multiple dimensions. Developing these essential competencies requires a personal disposition that can be enhanced by external support. In this context, we designed a learning teaching strategy called Student Question-Driven Learning (SQDL). In this paper, we explore the effectiveness of SQDL on student learning experience, decision-making ability and perception of freedom and autonomy. A positive effect of SQDL was observed among the experimental group students in terms of motivation, decision-making ability, and engagement.

Keywords: Question posing, self-directed learning, learning teaching strategy

1. Introduction

In a self-directed learning (SDL) environment, students are drivers of their learning. The focus of the classroom is shifted from teacher-directed to student-directed, and students are considered as agents of the complex interdependent individual in a dynamic social context. Essential elements of SDL are self-regulation, and freedom of choice, as highlighted by the literature (Manja Klemenc, 2017). Student agency presents a better conceptual framework of SDL since it captures and highlights elements of autonomy, choice and freedoms, which are the core premises of SDL.

A self-directed learner develops a rich experience of achieving their autonomous, intentional goal (Bandura, 2001). Students need the ability to seek, make sense of and act upon their intentional goal (Gourlay 2017) to develop their learning experience. According to Manja Klemenc (2017), Students' capabilities to influence learning processes are limited by the expectations as to their role and behaviours inherent in given cultural frames. Research indicates that students often face challenges in exercising their learning direction due to various factors. These include limited self-efficacy, a lack of personal or contextual resources, and insufficient participatory opportunities. Apart from the capability to accomplish a task, the student requires opportunities or support from external sources, like autonomy, freedom and choice to exercise their self-direction in learning.

In an educational context, student capability in self learning emerges dynamically through interactions with the outside world Matusov et al, (2016). Students should engage in authentic tasks that demand advanced collaborative practices (Damşa et al. 2010), which contribute to the development of each other, and exert influence on their educational trajectories (Klemenčič 2017). Capability to direct student learning emerges through the interaction of the constitutive components within a particular context, both human and non-human (Gravett 2020). Research shows that self-directed capabilities can be supported externally by an authentic task, where the student will exercise their self-direction with peers while interacting with the learning environment.

Based on the literature of self-directed learning and student agency to influence learning, we have selected constructs on student learning experience, like motivation, interests,

and engagement, on learning capabilities, like decision-making ability, and on perception of autonomy and freedom.

1.1 Motivation, Interests and Engagement

Self-directed learning, as described by Bandura (2001), is the capacity to initiate actions intentionally. The individual student has been associated with numerous constructs, such as goals, perceived control, self-efficacy, persistence, mastery, autonomy, and self-regulation. Each of these constructs captures one or more specific aspects of motivation and action (Bandura 2006, Ryan & Deci 2000). The adaptive regulation of developmental goals requires a person to use different motivational strategies during different phases of the goal-pursuit process.

Cognitive interests driven by curiosity, intellectual engagement, or the desire for knowledge play a critical role in shaping purposeful and goal-oriented behaviour, which is central to the SDL. Emotional interests provide the motivational energy for action, while cognitive interests guide the intellectual engagement necessary for goal-directed behaviour. SDL connects the two, enabling individuals to act intentionally, regulate their emotions and thoughts, and achieve desired outcomes Bandura, A. (2001), R. M., & Deci, (2000).

Engagement represents a reflection of the learning outcome. Engagement is a measure of learner effort to develop knowledge, skills, and competence aimed at learning goals (N. G. Holmes et al, (2020). According to the social constructivism context, engagement, one of the most important components of an effective learning process, is that students spend time and effort to learn the course content and skills, have a meaningful interaction with other people, and are emotionally involved in learning processes.

From the literature, we have found, that fostering SDL is supported by instructional practices, dialogue, student voice, adaptive teaching, and peer collaboration. The choices we open to students must be authentic choices through which students can see that their opinions and most importantly their actions can have a real impact on themselves and the world around them (Manja Klemenc, 2017). Self directed learner engage in authentic tasks that demand advanced collaborative practice, contribute to the development of each other, and exert influence on their educational trajectories (Klemenčič 2017).

1.2 Decision-making ability

Decision-making ability represents the ability of students to select an actual learning path or learning material among several choices available. N. G. Holmes, (2020) defines decision-making capabilities as the necessary capability to make decisions in their investigations. An autonomous self-directed learner acts for themselves and are internally motivated in their decision-making C. P. Niemiec et al., (2009).

1.3 Perception of Autonomy and Freedom

Perception of autonomy and freedom represent external supports required to exercise SDL ability and personal dispositions. According to Bandura, (2001) SDL is a reflective, autonomous, and intentional action of learners, based on their personal and professional convictions. According to N. G. Holmes et al, (2020) and Manja Klemenc, (2017), the SDL is the autonomy of making choices based on free will. Autonomous learners learn more efficiently and effectively because they have control over their learning processes and control their learning.

Freedom to choose what, when, and how to contribute to a learning process can motivate students to actively engage and achieve more. Freedom of choice/action is never total or automatic. But among actors who possess both the inclination and capacity for self-control, and who are willing to engage in the struggle to transcend their circumstances, a measure

of freedom is possible. Perception of Autonomy represents students realization of external power

In this paper, our broad research goal is to explore the effectiveness of our learning teaching strategy called SQDL on student learning experience, like motivation, interests, and engagement, on learning capabilities, like decision-making ability, and on perception of autonomy and freedom.

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2. Research Methodology

The Student Query-Directed Learning (SQDL), a question-posing-based strategy, is applied to second-year computer engineering undergraduates at a private engineering college affiliated with AICTE and Mumbai University, India. In the research setting a total of 34 students participated in the study. The SQDL strategy is divided into three phases. In the first phase, the teacher conducts a face-to-face lecture. During the second phase, students use Padlet tools to generate and share questions based on the foundational knowledge provided. They then prioritize their questions as well as those of their peers. In the final phase, the teacher gathers all the questions and addresses them in order of the priority set by the students. Experimental group students participated in all three phases of SQDL and filled post questionnaires and feedback forms. Control group students interacted with teachers traditionally and filled post questionnaires. Consent forms were filled out by every participant. Permission from the institute review board was taken before proceeding with this experiment.

2.1 Participants

34 second-year computer engineering students participated in the study. In the experimental group, there were 17 students, in the control group, there were 17 students. Among the control group students, one student only participated in the pre-questionnaire and study session but missed the post-questionnaire session. Similarly among the experimental group students, one student participated in the prequestionnaire and study session but missed the post-questionnaire session. A total of 32 students' data were collected. These groups were selected randomly. Of the participants, 70% (22) were male and 29.4% (10) were female. The students' ages ranged from 18 to 21 (M=19.31, SD=0.73).

2.2 Data Collection

Data is collected from experimental and control group students using a post-questionnaire. This questionnaire contains a total of 18 questions. Among these, 4 questions for interests, 4 questions for motivations, 3 questions for engagement, 3 questions for decision-making ability, 3 questions for perception of autonomy and 3 questions for perception for freedom. 5 point Likert scale was used to collect data where 1 represents *not at all true* and 5 represents *very true*. A total of four items measure interest. These items are adopted from Mazer, J. P. (2012), mean=29.9, SD=9.81 and Cronbach's alpha (α) is 0.90.

3. Results

We used descriptive statistics on post-test data to explore the general shape and spread of the control and experimental group data (see Tables 1 and 2). The experiment group consists of 16 students and the control group consists of 16 students respectively. Here our sample size is <50, so the Shapiro-Wilk test is used to check the normality of the data. The data is normal if the p-value is > 0.05 or W is closer to 1 (Table 3). Each mean median value is the summation of the mean and the median of different items under each construct.

Table 1. *Descriptive Statistics of Post-Test Data on Experimental Group Students*

	Experimental Grp	Interest	Motivation	Engagement	Decision-making ability	Perception of Autonomy	Perception of freedom
Mean	14.3125	7.75	12	11.6875	11.5	11.5	11.125
Media	15	8	12	12.5	12.5	12.5	11
SD	2.08866	1.390443	2.44948974	3.628015987	2.875181154	2.875181154	2.247220505

Table 2. *Descriptive Statistics of Post-Test Data on Control Group Students*

	Control Grp	Interest	Motivation	Engagement	Decision-making ability	Perception of Autonomy	Perception of freedom
Mean	15.0625	7.1875	8	11.625	10.99643375	10.99643375	10.125
Median	15	7	8	11	10.5	10.5	10.5
SD	1.611159	2.07	1.63299316	2.217355783	2.680174124	2.093641166	2.093641166

Table 3. *Shapiro-Wilk Test of Post-Test Data of Experimental and Control Group Students*

Variable	Control group		Experimental group		Summary
	Statistics (W)	P value	Statistics (W)	P value	
Interest	0.9435	0.3935	0.8893	0.05432	Normal, Normal
Motivation	0.9444	0.4064	0.9129	0.1297	Normal, Normal
Engagement	0.8973	0.07277	0.892	0.06	Normal, Normal
Decision-making ability	0.934	0.2873	0.8478	0.01267	Normal, Not Normal
Perception of Autonomy	0.9627	0.7101	0.893	0.06214	Normal, Normal
Perception of Freedom	0.9554	0.5799	0.8752	0.03265	Normal, Not Normal

3.1 *Interest*

In the post-test, there are, to explore within experiment and control group data, we considered Shapiro-Wilk's test for normality. For the item "*Today's class was boring*" (R), the experimental group and control group are not normal. Hence, to find a significant difference between them, we have used the Mann-Whitney U Test. The result shows that the p-value =0.000224, the test statistic Z-value = -3.6903, and the effect size is large (0.65). Item "*I understood the topic very well, discussed today*" in the experimental group and control group are not normal. Hence, we have used the Mann-Whitney U Test. The result shows that the p-value =0.002453, the test statistic Z-value =3.0291, U=207, and the effect size is large (0.54).

3.2 *Motivation*

For item "*Today's lecture is not motivating at all*" (R), as the experimental and control groups are not normal, we have used Mann Mann-Whitney U test. Resultant p=0.95216, U=126, and Z=-0.5653 and the effect size is small (0.01). For "*My main learning goal is to get good results*" , the experimental group is not normal, so we have used the Man-Whitney-U test gave a Z value of 0.879, U=151 and P=0.3794 and the effect size is small (0.16).

3.3 *Engagement*

For item "*I did not give the teacher full attention*" (R), as the experimental and control groups are not normal, we have used Mann Mann-Whitney U test. Resultant p=0.4.4, U=92.5, and Z=-0.8345 and the effect size is small (0.015). For item "*I try hard to do well in this class*" , the experimental and control groups are not normal, so we have used the Man-Whitney-U test gave a Z value of 0.1994, U=133 and P=0.8419 and the effect size is small (0.035).

3.4 *Decision-Making Ability*

For the item "*I can prioritise my decision about what I will learn next*", as the experimental and control groups are not normal, we have used Mann Whitney U test. Resultant p=0.9197, U=125, and Z=-0.1009 and the effect size is small (0.018). For the item "I let my teacher know what I am most interested in", the experimental group is not normal, so we have used the Man-Whitney-U test gave a Z value of 0.3294, U=137 and P=0.7419 and the effect size is small (0.58). For the item "*I can decide what is most important for me to learn next*" , the experimental group is not normal, so we have used the Man-Whitney-U test gave a Z value of 0.9848, U=153 and P=0.3247 and the effect size is small (0.17).

3.5. *Perception of Autonomy*

For the item "*I felt like I am learning what I want to learn*", as the experimental and control groups are normal, we have used an independent T-test. Resultant p=0.6531, T=-0.454 and the effect size is small (0.16). For the item "*Posing questions allows me to express my doubt*", the experimental group is not normal, so we have used the Man-Whitney-U test gave a Z value of 2.1542, U=182 and P=0.03123 and the effect size is medium (0.38).

3.6 Perception of Freedom

For the item "*I am not learning according to teacher choice*", as the experimental and control groups are not normal, we have used Mann Whitney U test. Resultant p=0.4976, U=146, and Z=0.6785 and the effect size is small (0.12). For *"I felt during this class, I expressed my preferences and options by priority"*, the experimental and control groups are not normal, so we have used the Man-Whitney-U test gave a Z value of 0.8441, U=150 and P=0.3986 and the effect size is small (0.15).

4. Discussion

In the construct of Interest, item emotional interests have p-value = 0.000224, Z = -3.6903, and effect size = 0.65 large. Hence it shows a significant difference between experimental and control group students. Similarly, cognitive interest represented by the item, *"I understood the topic very well, discussed today"* has p-value = 0.002453, Z = 3.0291, U = 207, effect size = 0.54 is large. It also shows a significant difference between the experimental group and the control group students. Among the construct of motivation, extrinsic motivation *"My main learning goal is getting good results"* showed a positive effect on experimental group students as compared to the control group students. Behavioural engagement *"My main learning goal is getting good results"* also shows a positive effect on the experimental group student as compared to the control group student. Among the decision-making ability, experimental group students have shown positive results where *"I let my teacher know, what I am most interested in",* though any combined effect is missing. It represents that experimental group students reflected their capability to decide their interests using SQDL. Among the perception of autonomy construct, experiment group students reflected a significant effect of SQDL captured by item *"posing question allows me to express my doubt",* where Z value is 2.1542, U=182 and P=0.03123 and the effect size is medium (0.38). Experimental group students also showed a positive effect of SQDL by item "*I let my teacher know what I want to learn"*. Any combined effect of the perception of autonomy is missing. Among perceptions of freedom, experimental group students showed a positive effect on all items.

Conclusion

The combined analysis of all interest items shows a significant impact of the intervention with a large effect size. SQDL was capable of significantly revealing students' emotional and cognitive interests and positive extrinsic motivation in learning. Interests and motivation are key factor that represents students' desire to learn in a subject in a face-to-face classroom setting. experimental group students realised and reflected on their perception of autonomy and freedom to learn, which is provided by the SQDL.

This experiment is an exploration of different dimensions of SQDL. It shows that SQDL helped students to realise and reflect on some of the internal dispositions using its intervention by providing external support.

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