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## **INVESTIGATION OF THE EFFECTIVENESS OF USING SELF- DETERMINATION THEORY IN TEACHING BIOLOGY FOR GRADE TEN STUDENTS**

**H.P.R. Menike<sup>1</sup>, W.D. Chandrasena<sup>\*2</sup>**

<sup>1</sup> Postgraduate Institute of Science, University of Peradeniya, Sri Lanka

<sup>\*2</sup> Science Education Unit, Faculty of Science, University of Peradeniya, Sri Lanka

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### **Abstract**

Biology is a very important discipline as it focusses on structure and functions of living organisms in this world. Hence, it has become a significant area of study in school curriculum and it is also a main subject discipline in the Grade 10 science syllabus in Sri Lanka. The time allocated for the biology section in Grade 10 syllabus is one third of the total time. Although, biology is perceived as an easy discipline to study compared to other disciplines in science, students' achievement in biology is not very satisfactory. Thus, there may be different reasons for students' poor achievement in biology such as content in the syllabus, teaching style, students' learning and studying habits, students' negative feeling and attitudes towards the topics, and lack of enough resources (Cimer, 2011). The practices based on Self-Determination Theory (SDT) could be used in biology classrooms to enhance students' enthusiasm towards learning. SDT is an important psychological theory of motivation and it addresses issues of extrinsic and intrinsic motivation. According to SDT people have three innate psychological needs: competence, relatedness, and autonomy. If these universal needs are met, the theory argues that people will function and grow optimally. Thus, to actualize their inherent potential, the social environment needs to nurture these needs (Deci & Ryan, 2014). However, there is a dearth of research and practices in Sri Lankan school classrooms using SDT to facilitate students' learning. Hence, the unit of "Classification of Organisms" in Grade 10 syllabus was selected to study the effectiveness of SDT in teaching biology for Grade 10 students. "Classification of Organisms" is an important unit since it is the foundation of learning about different types of living beings. This is an experimental study and two groups of students were used as control and experimental. Experimental group is taught using the SDT and the control group is taught according to the traditional method. During the lessons observations were made while maintain the records of field notes. The collected data were analysed using thematic analysis. Students' motivation, engagement, enthusiasm, and performance in both groups were compared. The results of the study showed that the above characteristics are higher in the experimental group compared to the control group. Thus, the classroom practices based on the SDT can be used as a good technique in teaching biology in order to enhance the students' intrinsic motivation.

**Keywords:** Biology; Education; Intrinsic Motivation; SDT; Grade 10 science.

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## 1. Introduction

Biology is a very important discipline as it focusses on structure and functions of living organisms in this world. There are no of facts that prove to the importance of biology. Biology education gives an in depth understanding of how living organisms and nonliving things interact. It also gives in sight on the diversity of living organisms. Biology provides the knowledge about how the human body changes with the time and the changes in behavior. It also gives expiations for different kind of diseases of human as well as animals and this leads to development of fields of pathology and pharmacology. Biology is important to shape up many carriers such as physicians, nurses, pharmacists, radiotherapists, dietitians, physiotherapists, beauticians, teachers, researches in agriculture field technicians and laboratory workers. There are many global issues that have to be addresses promptly. Some of them are pollution, shortage of food, global warming etc. To find answers for those environmental issues knowledge of biology is essential. Other important advantage of knowledge of biology is to identify suitable foods for individuals depending on their age, health condition and occupation. Researches are helpful to find new things in the world, biology helps to provide the scientific way for conducting researches (“Importance of Biology” 2018). The answer for beginning of life on the earth is explained by the biology although there some religious believes. Hence, it has become a significant area of study in school curriculum and it is also a main subject discipline in the Grade 10 science syllabus in Sri Lanka. The time allocated for the biology section in Grade 10 syllabus is one third of the total time. Although, biology is perceived as an easy discipline to study compared to other disciplines in science, students’ achievement in biology is not very satisfactory. Thus, there may be different reasons for students’ poor achievement in biology such as content in the syllabus, teaching style, students’ learning and studying habits, students’ negative feeling and attitudes towards the topics, and lack of enough resources (Cimer, 2011).

The practices based on Self-Determination Theory could be used in biology classrooms to enhance students’ enthusiasm towards learning. SDT is an important psychological theory of motivation and it addresses issues of extrinsic and intrinsic motivation. This theory was initially developed by Edward L. Deci Richard M. Ryan and that has being applied to different fields like education, healthcare, psychotherapy, sports and exercise, environment etc. According to SDT people have three innate psychological needs: competence, relatedness, and autonomy. If these universal needs are met, the theory argues that people will function and grow optimally. Thus, to actualize their inherent potential, the social environment needs to nurture these needs (Deci & Ryan, 2000).

In different countries researches have been conducted to investigate the usefulness SDT in education. J. Painter in U.S.A. has studied students’ achievement in science by using a proposed motivational model based on self-determination theory. In Canada Lavigne, Vellerand and Miquelon (2007) have conducted a study to propose and test a motivational model of persistence in science education in STD approach. Ahn (2014) has studied on Relations between teachers’ motivation and student’s motivation with relation to SDT perspective. However, there is a dearth

of research and practices in Sri Lankan school classrooms using SDT to facilitate students' learning. Thus, the effectiveness of SDT to enhance the students' achievement in biology was tested in this research.

## 2. Materials and Methods

This research is an experimental study and two groups of students were used for the study. The sample was selected from a Central college in the Kegalle district in the Sabaragamuwa province. This test sample of this school was selected since its easy accessibility. Each group was consisting of 30 students in grade 10. The unit of "Classification of Organisms" in Grade 10 syllabus was selected to study the effectiveness of SDT in teaching. "Classification of Organisms" is an important unit since it is the foundation of learning about different types of living beings. This unit is scheduled for the second term and it was completed during early part of the term. The experimental group is taught using the SDT and the control group is taught according to the traditional method. The lessons for the experimental groups were planned in order to improve students' intrinsic motivation by providing opportunities to fulfill autonomy, competency and relatedness. The lessons for the control group were planned as lectures and discussions.

### Instrumentation

Before starting the unit students existing knowledge about the "Classification of Organisms" was tested using a pre-test that was prepared according to the short answers technique in order to assess the effectiveness of using SDT for teaching learning process of "Classification of organism". After the completion of learning the unit students' knowledge was tested using a structured question paper. During conducting the lessons students' behavior, facial expressions, interaction with other students, sharing quality in puts among group members, and reactions to the teacher when asking questions, politeness, initiation were observed and field notes were maintained. In addition to that photograph and videos were taken with the help of other teacher.

Students' motivation before and after implementing the teaching learning process was evaluated using a Likert questionnaire. The degree of students' perception of three basic psychological needs or the classroom climate in both experimental and control group was also evaluated using a questionnaire.

### Data analysis

The qualitative data collected were analysed using thematic analysis and the software SPSS was used for the analysis of quantitative data gathered from questionnaires. Students' motivation, engagement, enthusiasm, and performance and fulfillment of psychological needs in both groups were compared.

## 3. Results and Discussion

The results of the study showed that student's characteristics like motivation, engagement, enthusiasm, and performance are higher in the experimental group compared to the control group. As seen in the Figure 01 average score of intrinsic motivation of the students in the experimental group is high when compare to the control group. As well as intrinsic motivation other types of motivation ego and mastery are also high in the experimental group. Furthermore, according to

the Table 01 the score values are significantly different at 95% confidence level since probability is less than 0.05.

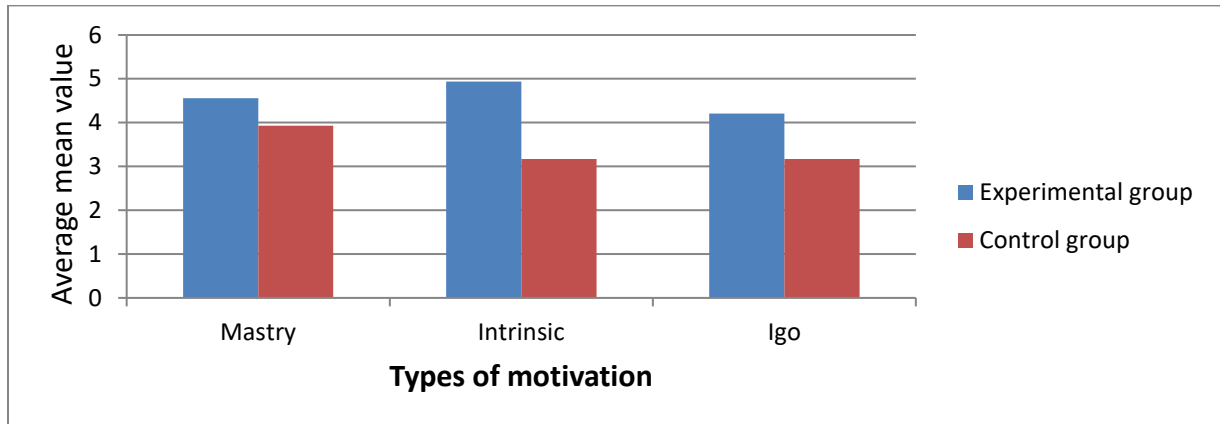


Figure 2: Average mean value of the score for students' motivation

Students in the testing group were highly motivated and frequently ask to conduct biology lessons in other periods as well. They showed their willingness to do group activities, presentations, field works, and watch videos about different organisms. Thus, the classroom practices based on the SDT can be used as a good technique in teaching biology in order to enhance the students' intrinsic motivation.

Table 1: Students' motivation after learning the unit of "Classification of organisms"

Type of motivation	Mean value of the experimental group	Mean Value of the control group	P value
Mastery	4.56	3.93	0.000
Intrinsic	4.94	3.17	0.000
Ego	4.21	3.14	0.000

Students in the SDT class have experienced more autonomy support than the students in the control group. At the same time they have developed competency and relatedness more than the students in the control group as seen in the Figure 2.

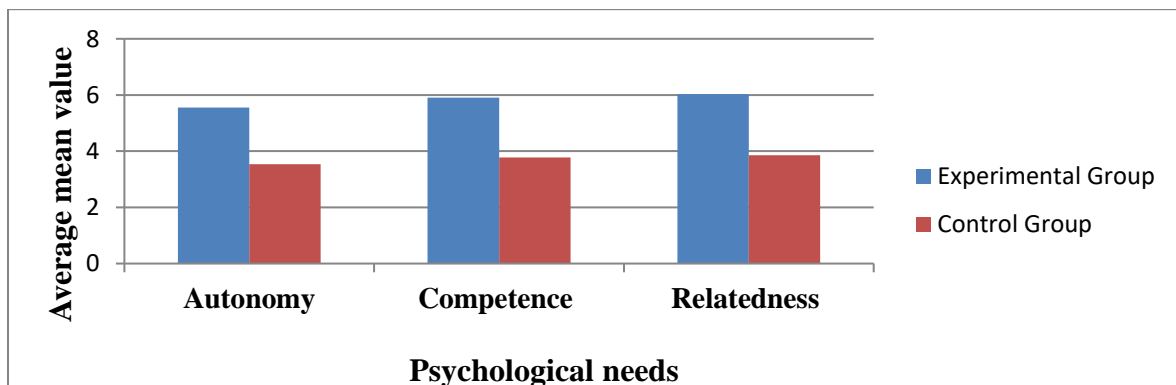


Figure 2: Average mean values of the scores for the students' fulfillment of psychological needs in the experimental group and the control group after learning "Classification of organism"

Table 2: The average mean value of the fulfillment of psychological needs

Type of support	Average mean value of experimental group	Average mean Value of control group	P value
Autonomy	5.55	3.54	0.000
Competence	5.91	3.78	0.000
Relatedness	6.03	3.85	0.000

The results of this study showed the performance of the students in the experimental group is higher than the performance of the students in the traditional class. As indicated in the Table 3 there is no significant difference between the pretest marks of the students in the experimental group and the control group. However there is a significant difference between the posttest marks of the students in two groups ( $p < 0.05$ ).

Table 3: Mean values of pre-test marks and post-test marks of the students in the experimental group and the control group

Type of the test	Experimental group	Control group	P value
Pre-test	19.13	18.70	.869
Post-test	73.70	55.30	.000

#### 4. Conclusion

According to the results of this study it is evident that there is a remarkable effect of teaching method on the performance of the students. Although most of the science teachers deliver their lessons to students in almost all the grades by using lecture method and discussions the best way is to improve students' intrinsic motivation. Moreover, it is important to create a good learning environment in the science classrooms for meaningful learning. The application of Self-Determination Theory (SDT) that focuses on psychological relatedness, competence, and autonomy support in science classrooms will increase students' intrinsic motivation.

#### References

- [1] Ahn, I (2014) Relations between teachers' motivation and students' motivation: A self – determination theory perspective. Open access Thesis 725. retrieved from [http // docs.purdue.edu/ open \\_thesis/725](http://docs.purdue.edu/open_thesis/725)(accessed 18, July,2018).
- [2] Cimer, A. (20012), What makes biology learning difficult and effective students' views. Educational research and reviews. Vol.7 (3) pp.61-71.
- [3] Importance of biology, (2018) Retrieved from (Se2018). Retrieved July 18, 2018, from <http://selfdeterminationtheory.org/> ( Accessed 18,July2018).
- [4] Lavigne,G.L., Vellerand T.R. and Miquelon,P (2007) European Journal of Psychology of education. Vol.xxii, n3,351-369.
- [5] Painter, J (2011) Autonomy, competence and intrinsic motivation in science education: A self-determination theory perspective. Ph.D thesis, University of North Carolina at Chpell Hill.
- [6] Ryan, R. M., and Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist*, 55(1), 68.

\*Corresponding author.

E-mail address: wdchand@gmail.com