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Homogeneity and Heterogeneity as Strategies for Enhancing Student Performance

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Abstract

This paper shows the learning adaptability of the student as a social atom when classified in a homogeneous and heterogeneous classroom settings. The complex interaction of the students will eventually determine which class grouping strategy is more effective for enhancing student performance. The study made use of the complex adaptive system technique where 100-run simulation was performed. Results show that the students adapt more in a homogeneous section rather than in the heterogeneous classroom setting. For slow learners, despite their "most likely to fail" behavior as an individual, will tend to improve academic performance when they interact with peers of the same learning capability.

Keywords: adaptability, complex adaptive systems, heterogeneous, homogeneous, social atom

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1.0 Introduction

Heterogeneous and homogeneous class sectioning is the practice of dividing students for instruction on the basis of their perceived capacities for learning. It is the practice of placing students of similar academic level within the same group of instruction. However, issues such as the impact of attitudes towards grouping, the role of gifted students as role models for other students, and the impact of grouping on student behavior and teacher expectations are all crucial. Some critics say that it is just another form of racial segregation; for when students are divided on the bases of ability grouping, they are also divided by race and economics.

Analysis by Lou et al., (1996) homogenous and heterogeneous grouping had a differential effect on students learning. It was generally revealed that the homogenous groups achieve more than the heterogeneous in studies. In addition, Kulik's (1985), Slavin (1988, 1990) and Veldman and Sanford (1984) stated that ability grouping considered a sensible response to academic diversity which includes addressing important issues about ability grouping for academic instruction. Issues such as the role of each student as role model to other student and the impact of grouping to student behavior as well as the instructor's expectations are all crucial. On the other hand, Emily et al., (2003) reported that neither homogeneous nor heterogeneous ability grouping class is uniformly superior for promoting achievements of students. She revealed that the factors influencing student's learning outcome include attitude and lack of interest towards learning.

Various researches and Meta-analysis reports both nationally and internationally on this issue revealed divergence opinion which makes research to this end inconclusive. Methods used by most of the authors on this issue were purely actual and experimental on different class environment. However, there is none, if not limited, that focuses on student adaptation after interaction occurred in a given period of time.

This study aimed to determine the class sectioning strategy that would be beneficial for students to adapt and learn, and eventually improved their academic performance. The study made use of the descriptive complex adaptive system technique where artificial worlds are created to investigate this phenomenon. The macroscopic characteristics that are observed are assumed to have come from the complex interactions of the students in the class environment. Through these interactions, the students learn or adapt and change their strategies to maximize benefits to themselves.

2.0 Research Design and Methods

The study utilized the model of complex adaptive system in which learning behavior of the students emerge due to its interaction with another students of differentiated learning capability. In this study, the aggregate element is the academic remarks of the student as listed: (1) Most likely to fail; (2) May pass or fail; (3) Most likely to pass and the social atoms are the students which are classified into 3 groups: Fast Learners (FL), Average Learners (AL), Slow Learners (SL). Each social atom performs natural action as stated below:

If Slow learner (SL), then most likely to fail.
If Average learner (AL), then he/she may pass or fail.
If Fast learner (FL), then most likely to pass.

On the study of Adodo and Agbayewa (2011), the interaction among homogeneous, in this case slow learners, would tend to better promote student achievement and is in line with Research -based Information on Timely Topics reports of (2002) that homogeneous class produces large gain in students than heterogeneous class. Since student's interest to learning is boosted and sustained in homogeneous class, the slow learners feel more comfortable and participate more when they are grouped with peers of similar learning ability. Furthermore, slow learners are usually stigmatized, uncared for in a heterogeneous class grouping. On the basis of this claim, the table below shows the interaction and adaptation details of the social atoms.

Table 1. Interaction and adaptation table of the social atom

Social Atom	Natural Action	Interaction	Likelihood of Interaction	Adaptation
Slow Learner (SL)	Most likely to fail	Slow learner-Fast learner	[.2 , .6]	None
		Slow learner-Average learner	[.3 , .7]	May pass or fail
		Slow learner - Slow learner	[.6 , .8]	May pass or fail

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When social atoms interact, they tend to adapt, thus new learning behavior emerged. The algorithm below was used in the study:

Algorithm:

1. Generate n = 50 students and numbered 1 to 50.
2. Generate discrete random numbers as follows:
   1 = Slow learner (30%)
   2 = Average learner (60%)
   3 = Fast learner (10%)
3. Generate the natural action as follows:
   1 = Most likely to fail
   2 = May pass or fail
   3 = Most likely to pass
4. Create interaction table of Slow Learner (SL) atoms with heterogeneous and homogeneous environment as follows:

Table 2. Slow learner interaction with other social atom

Social Atom (X)	Social Atom (Y)	Environment
Slow Learner (SL)	Fast Learner (FL)	Heterogeneous
Slow Learner (SL)	Average Learner (AL)	
Slow Learner (SL)	Slow Learner (SL)	Homogeneous

5. Do a 100-run simulation of interaction. Use the mini-tab software to generate random data and consolidate based on the actual range as shown in the table below.

Table 3. Basis for consolidation after generating simulated data

Interaction	Probability	Mean	Normalized	Actual Range
SL - FL	[.2, .6]	.4	.25	0 - .25
SL – AL	[.3, .7]	.5	.31	.26 - .56
SL – SL	[.6, .8]	.7	.44	.57 - 1

6. Count the total number of interactions after 100-run simulation is completed.

3.0 Results and Discussion

After the 100-run simulation had been performed, below were the results of the procedure, analysis and interpretation of data in response to statement of the problem of this study. Figure 2 shows the likelihood of interaction among slow learners. On average, there were ten (10) slow learners interacting with other slow learners.

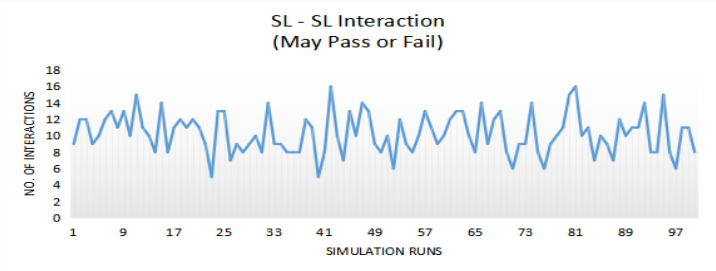

Figure 2. Graph of "slow learners to slow learners" interactions

Figure 3 reveals the likelihood of interaction between slow learners and average learners. On average, there were seven (7) slow learners interacting with average learners.

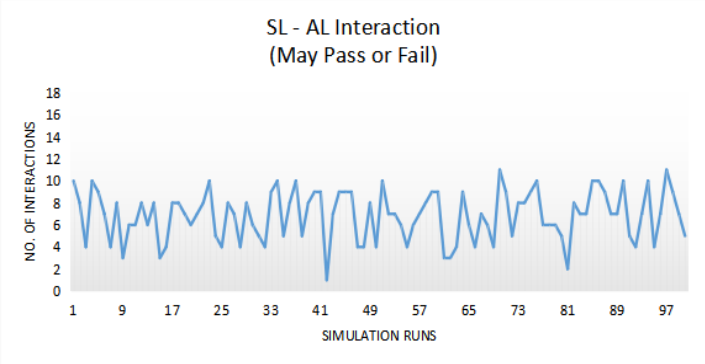

Figure 3. Graph of "slow learners to average learners" interactions

Figure 4 below reveals the likelihood of interaction between slow learners and fast learners. On average, there were six (6) slow learners interacting with fast learners.

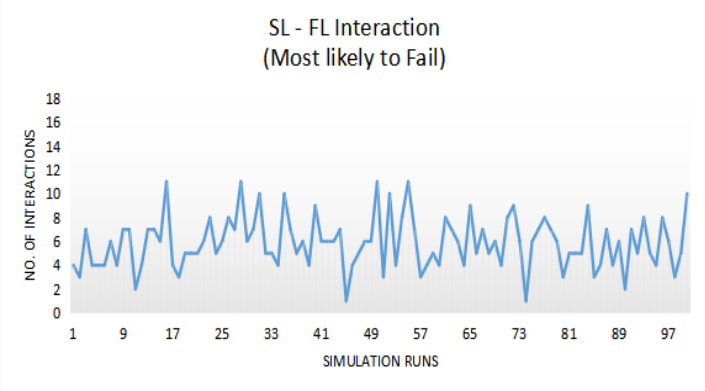

Figure 4. Graph of "slow learners to fast learners" interactions

The graph below reveals that more slow learners opted to interact with other slow learners and fewer slow learners opted to interact with fast learners (Figure 2). This supports the claim of Adodo and Agbayewa (2011) that slow learners feel more comfortable and participate more when they are grouped with peers of same ability. Figure 5. Results of the 100-run simulation of slow learners (SL) interacting with fast learners (FL), average learners (AL), and other slow learners (SL).

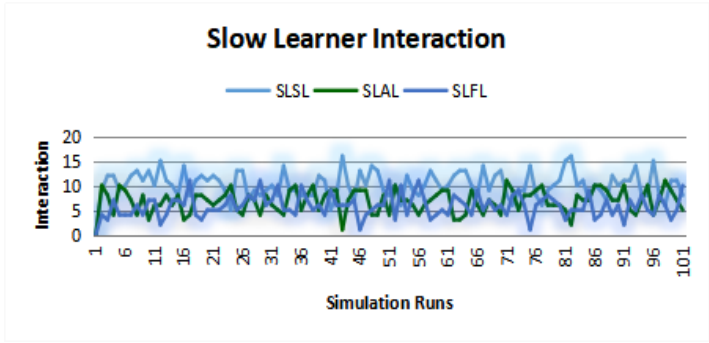

Figure 5. Results of the 100-run simulation of slow learners (SL) interacting with fast learners (FL), average learners (AL), and other slow learners (SL)

Table 4 indicates the number of interaction events of slow learners with other social atoms. On average, 44% or 10 out of the total slow learners (23) interacted among other slow learners while 30% and 26% of them interacted with average learners and fast learners respectively. Apparently, even in heterogeneous class, slow learners tend to interact more among other slow learners as compared to average and fast learners.

Table 4. Number of slow learner interaction with other social atoms

Class	Interaction		Averaged Percentage	Adaptation
Heterogeneous	SL-SL	10	44	May pass or fail
	SL-AL	7	30	May pass or fail
	SL-FL	6	26	Most likely to fail
Homogeneous	SL-SL	23	100	May pass or fail

Table 4 shows that the original twenty three (23) slow learners have adapted new behavior from "Most likely to fail" to "equal probability of "May pass or fail" after interacting to different social atoms.

Table 5. Adaptation of the slow learner social atoms after interaction in heterogeneous and homogeneous class grouping

Social Atom	Behavior	Original	Heteroge-neous	Homoge-neous
Slow Learner	Most likely to fail	23	6	0
Average Learner	May pass or fail	0	17	23

Table 5 shows the initial twenty-three (23) slow learners subject for interaction to both heterogeneous and homogenous class setting. Results show that in heterogeneous setting, seventeen (17) slow learners have adapted to average learner while six (6) learners remain slow. The probability of adaptation in heterogeneous setting is lower by 26% than the homogeneous setting where all twenty-three (23) slow learners have adapted to average learners.

The figure below graphically presents that homogeneous class showed more positive adaptability of the slow students than heterogeneous class.

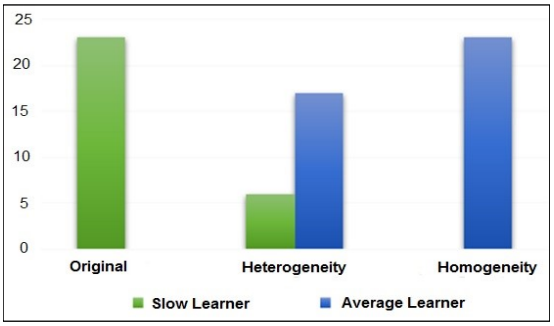

Figure 6. Slow learner adaptation

4.0 Conclusion

Slow learners evidently interact with other slow learners more frequently than with fast and average learners. The interaction of the social atoms of the same learning capability tends to mutually adapt positive behavior towards learning. Unlike in heterogeneous, homogeneous class setting provides the slow learners equal opportunity and allows healthy competition among them which improves their learning attitude and participation. With this environment, students will participate in various classroom activities with more confidence and less likely to concern on committing mistakes. Therefore, homogeneous is more effective class grouping strategy in enhancing student performance.

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