Research Journal of Education
ISSN(e): 2413-0540, ISSN(p): 2413-8886
Vol. 7, Issue. 1, pp: 29-35, 2021
URL: https://arpgweb.com/journal/journal/15
DOI: https://doi.org/10.32861/rje.71.29.35

Academic Research Publishing Group

Original Research **Open Access**

The Role of Science High School Optional Curriculum and Knowledge Coherence in the Science Academic Success of Students in the First Year of University Studies

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Article History
Received: January 5, 2021
Revised: January 24, 2021
Accepted: January 30, 2021
Published: February 2, 2021

Abstract

The purpose of the study is to investigate the relationships between the science high school optional curriculum, knowledge coherence, and science academic success of first-year students at university. The correlational quantitative approach, the structured questionnaire, and a non-random sample of students were selected to be used in the study. The study found a high positive correlation between science high school optional curriculum and science academic success variables (r = .608). It is also revealed that the total variance of science academic success explained by knowledge coherence level is 33.8%, the other variance may be explained by other variables. The study found that high school optional curriculum, as well as knowledge coherence, predicts science academic success.

Keywords: Science high school optional curriculum; Knowledge coherence; Science academic success.

1. Introduction

The science high school optional curriculum, and knowledge coherence are considered to be the important variables that impact science academic success of first-year students at university. The changes in the pre-university curriculum appear to have created new challenges related to students' transition to higher education programs. Till now little is known about the specific requirements students perceive as critical for their first-year experience and how the pre-university curricula are preparing them toward the road to success.

The main aim of the study is to investigate the relationships between the science high school optional curriculum, knowledge coherence, and science academic success of first-year students at university.The research questions include: (1): Is there a significant relationship between the science high school optional curriculum and science academic success in the first year of university studies? (2)Is there a significant relationship between knowledge coherence and science academic success in the first year of university studies? Is variance on academic success in the first year of university studies explained by science high school optional curriculum and knowledge coherence?

2. Literature Review

The Relationships between the Science High School Optional Curriculum and the Science Academic Success.

New experiences, transitions, and unknown situations during the first year of the university can throw students in the loop of challenge. This, important period of adjustments and great change give students at the same time the opportunity to grow excitingly and constructively. On the other side, the challenge for higher education and their academic staff is how to ensure that the university's first-year transition is impacting students positively and confidently (Costain, 2017). Trautwein and Bosse (2017) in their review identified a broad range of personal, organizational, content-related, and social requirements students perceived as critical for the transition to higher education. Individual students also experience an accumulation of first-year challenges revealing the interconnectedness of critical requirements. Many studies seek to explore the first-year challenges in higher education from the student point of view and also from a university perspective. Different studies indicated that there is a positive relationship between free or optional curriculum content at high school and academic progress of students at the university level (Costain, 2017; Legters and Kerr, 2001; Neild *et al.*, 2007; Shelton and Brown, 2010; Trautwein and Bosse, 2017; Webb, 2002). Based on the literature review higher education is going through four main management and structural challenges during the first year of the university about their students. They have to elaborate support programs, they have to prepare recommendations for transition programs; they have to share with their staff the best practices in transition courses, and to identify and share with their staff the current program and

course models in use in terms of structure and curriculum that fit better with this transition period (Costain, 2017). Most studies that focus on student success during the first year of the university relate it with the student's characteristics as social-economic background, attitudes, motivation, study habits, and previous academic achievement. But there are data's that shows also the role of curriculum alignment in this process, because as Biggs, 2003 say the quality of learning, lies within the curriculum that is planned and in the relationship of skills and knowledge between curricula levels (Bateman *et al.*, 2007). This is the reason that in most educational models learning outcomes and academic achievements in the university are related to former levels of achievements too (Grayson, 2008). Therefore, it is hypothesized that:

The Variance in Science Academic Success in the First Year of University Studies is been Explained by the Science High School Optional Curriculum.

The Relationships between the Knowledge Coherence and the Science Academic Success.

According to literature data in many cases, students arrive in university underprepared from an academic point of view and they usually are underprepared also for the rigorous curriculum demands that are not anymore organized by grade level but are organized based on content specialty. For most students, this transition period is characterized by the increase in homework, assessments, and other assignments that are a little supported by their pre-academic preparation (Costain, 2017; Legters and Kerr, 2001; Neild *et al.*, 2007). In many situations, students claim that they have never practiced a particular skill or heard of a particular theory in their pre-university curriculum, except for knowledge coherence. This situation has a big impact on teaching content and methods used during the first year of the university because a curriculum has to be built upon already existing knowledge and skills. The alignment in the knowledge curriculum is one of the variables that impact the academic success of the students at university, especially in natural sciences (Wijngaards-de Meij and Merx, 2018). Knowledge coherence and alignment looks to be one of the most important factors in the support of academic success during the first year of university studies. Alignment is a measurement of the relationship between different components of an educational system (Shelton and Brown, 2010). Roach *et al.* (2008) indicate that alignment can be seen as the extent to which curricular expectations and assessments are in agreement and work together to guide educators' efforts to facilitate students' progress toward desire academic outcomes . Alignment also is defined as the extent to which expectations, in the form of standards, match the assessments intended to measure them. The alignment is a measure of the relationship between the system components (Webb, 2002). Alignment indicates how well the parts of the systems work together to guide student learning and expectations (Shelton and Brown, 2010; Webb, 2002). The rigor of courses taken in high school is the most powerful predictor of academic achievement, high school graduation, and enrollment in postsecondary education (ACT, 2004; Adelman, 1999; Braddock, 1990; Gamoran, 1987; Oakes, 1987). Bateman *et al.* (2007), found out that there is a significant relationship between the knowledge coherence (alignment) and high school optional curriculum and academic success in the first year of university studies. This design is a model of institutional development that is grounded scientifically, to drive curriculum and program development and increase the quality of student learning Therefore, it is hypothesized that:

The Variance in Science Academic Success in the First Year of University Studies is been Explained by the Knowledge Coherence.

The Relationship between the High School Optional Curriculum, Knowledge Coherence, and the Science Academic Success.

Research has demonstrated that students who take more intense academic programs in high school attend and persist in higher education at a greater rate than students who take less difficult programs of study (ACT, 2004; Adelman, 1999; Fry, 2004; Herold, 2003). The need for coherence and alignment among curriculum is a fundamental principle of educational practice. In a coherent or aligned curriculum, like Biggs, 1999 indicates, all components in the teaching system, the curriculum and its intended outcomes, the teaching methods, the learning activities, the assessment tasks, and resources to support learning are aligned. When these conditions have been created, the learner finds it difficult to escape without learning (Bateman *et al.*, 2007; Biggs, 1999). Creating a coherent curriculum appears to be a simple, need for an important solution to a complex problem, but as literature data show curriculum coherence and alignment between high school and university are not yet the norm (Bateman *et al.*, 2007; Biggs, 2003). Newmann *et al.* (2001), show a positive relationship between free and optional high school curriculum, as well as knowledge content with students' academic progress (Bateman *et al.*, 2007; Newmann *et al.*, 2001). Despite the importance of this process, there exists a lack of alignment between high school experiences and college expectations that impacts student achievement in the transition between those two levels of education. Literature data show that these barriers affect less the students that participate in in-depth elective courses in secondary education. Those students it seems that are better prepared to successfully finish the first year of the university (Kirst *et al.*, 2003; Shelton and Brown, 2010) and this looks like an important suggestion to help improve student success in the first year. Also (Kirst *et al.*, 2003) suggest that a better articulation between K-12 and postsecondary educational systems is an important tool toward student success in the first year of the university.

Educational systems that are lacking horizontal or vertical alignment also lack information and consistency regarding background information support and leading management structures for their students on how to learn and achieve learning objectives during the educational period. The differing expectations between the secondary and postsecondary education systems lead many times to confusing messages regarding what is expected from students in the first year of the university. Without the alignment between standards, exams, and expectations, students do not receive clear and consistent information regarding their progress toward meeting college readiness expectations (Webb *et al.*, 2007). Coherence seems to be an important factor that influences student performance and their achievement levels, therefore, investigating the alignment and coherence among components in the educational

system between high school and the university is an important task for a better education system of tomorrow (Costain, 2017; Shelton and Brown, 2010). Therefore, it is hypothesized that:

The variance in science academic success in the first year of university studies is been explained by the high school optional curriculum and knowledge coherence.

3. Methodology

3.1. Method and Design

The method used in the research was the quantitative approach. The correlational research design was used to test the research hypothesis. The respondents were selected using existed students in the first year of university studies of natural sciences faculty of the main university in the country.

3.2. Sample and Data Collection

The sample of the research has been compounded by first-year university students (N=99) of natural sciences faculty of the main university in the country. A breakdown of a non-random sample of the respondents included 54 females (54.5%), and 45 (45.5%) males.

A structured questionnaire was used to gather primary data for science high school optional curriculum, knowledge coherence, and science academic success variables.

3.3. Analysis

The central tendency and frequency values were used to describe the science high school optional curriculum, knowledge coherence, and scienceacademic success variables. The relationship between science high school optional curriculum, knowledge coherence, and science academic success was investigated using Pearson' r correlation coefficient. The prediction of the science academic success by the science high school optional curriculum and knowledge coherence was investigated by linear bivariate and multivariate regression. The assumption testing was conducted to check for normality, linearity, outliers, as well as the homogeneity of variance-covariance matrices and multicollinearity, with no violations noted.

4. Results and Discussion

4.1. Descriptive Analysis

Table-1. Science high school optional curriculum frequencies

Science high school optional curriculum					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Very low level	5	5.1	5.1	5.1
	Low level	17	17.2	17.2	22.2
	Moderate level	34	34.3	34.3	56.6
	High level	43	43.4	43.4	100.0
	Total	99	100.0	100.0	

Science high school optional curriculum variable frequencies showed that 22.3% of the respondents are reported to have a very low or low level of science high school optional curriculumknowledge and skills; 34.4% of them reported a moderate level of science high school optional curriculum knowledge and skills, and 43.5% of them are reported to have a high level of science high school optional curriculumknowledge and skills. Central tendency values (M = 2.16; DS = .88) confirm the same tendency. Therefore, less than half of respondents (43.4%) reported a high level of science school optional curriculumknowledge and skills; meanwhile, less than ¼ of them (22.3%) reported to have a very low or low level of science high school optional curriculum knowledge and skills. In conclusion, the science high school optional curriculum affects most of the students' knowledge and skills (77.7%) at moderate and high levels.

Table-2. Knowledge coherence frequencies

Knowledge coherence					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Mathematics	22	22.2	22.2	22.2
	Physics	25	25.3	25.3	47.5
	Chemistry	35	35.4	35.4	82.8
	Biology	17	17.2	17.2	100.0
	Total	99	100.0	100.0	

Knowledge coherence variable frequencies showed that 22.2% of the respondents are reported to have theknowledge coherence with Mathematics; 25.3% of them are reported to have the knowledge coherence with Physics; 25.4% of them are reported to have the knowledge coherence withChemistry, and 17.2% of them are reported to have the knowledge coherence withBiology.

Central tendency values (M = 1.47; DS = 1.02) confirm the same tendency. Therefore, ¼ of students (25.4%) are reported to have the knowledge coherence with Chemistry, another ¼ of them are reported to have the knowledge coherence with Physics; meanwhile, a little more than 1/5 of them (22.2%) are reported to have the knowledge coherence with Mathematics, and less than 1/5 of them (17.2%) are reported to have the knowledge coherence with Biology.

In conclusion, the Chemistry and Physics at the university level are characterized with more knowledge coherence (25.4%; 25.3%) with science high school optional curriculum; meanwhile, the Mathematics and Biology at the university level are characterized with less knowledge coherence (22.2%; 17.2%) with science high school optional curriculum.

Table-3. Science academic success frequencies

Academic success					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Mathematics	19	19.2	19.2	19.2
	Physics	24	24.2	24.2	43.4
	Chemistry	23	23.2	23.2	66.7
	Biology	33	33.3	33.3	100.0
	Total	99	100.0	100.0	

Science academic success variable frequencies showed that 19.2% of the respondents are reported to have academic success in Mathematics; 24.2% of them are reported to have academic successin Physics; 23.2% of them are reported to have academic success in Chemistry, and 33.2% of them are reported to have the academic success inBiology.

Central tendency values (M = 1.70; DS = 1.12) confirm the same tendency. Therefore, 1/3 of students (33.2%) are reported to have academic success in Biology, and less than ¼ of them (24.2%) are reported to have academic success in Physics; meanwhile, a little less than ¼ of them (23.2%) are reported to have the academic success in Chemistry, and less than 1/5 of them (19.2%) are reported to have the academic success in Mathematics.

In conclusion,the most number of students (33.2%) are reported to have academic success in Biology, followed by 24.2%of them that are reported to have academic success in Physics,23.2% of them that are reported to have academic success in Chemistry, and 19.2% of them that are reported to have the academic success in Mathematics.

4.2. Inferential Analysis

4.2.1. H1

The variance in science academic success in the first year of university studies is been explained by the science high school optional curriculum.

Table-4. Correlation outputs of the relationship between science high school optional curriculum and science academic success variables

Correlations			
		Academic success	**High school optional curriculum**
Pearson Correlation	Academic success	1.000	.608
	High school optional curriculum	.608	1.000
Sig. (1-tailed)	Academic success	.	.000
	High school optional curriculum	.000	.
N	Academic success	99	99
	High school optional curriculum	99	99

The outputs of the Pearson correlation indicate that there is a high positive correlation between science high school optional curriculum and science academic success variables, r = .608, n = 99, p < .005. The value of correlation points out that increasing science high school optional curriculumvalues would increase the science academic success level. So, there is a high positive correlation betweenscience high school optional curriculum and science academic success variables.

Table-5. R Square values of the relationship between science high school optional curriculum and science academic success variables

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.608[a]	.370	.363	.89952	.370	56.874	1	97	.000

a. Predictors: (Constant), High school optional curriculum

The regression outputs show that the total variance of science academic success explained by science high school optional curriculumlevel is 37%, F (1, .667), p < .005. The other variance may be explained by other variables.

Table-6. Multivariate regression outputs of the relationship between science high school optional curriculum and science academic success variables

Coefficients[a]									
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	.040	.239		.169	.866			
	High school optional curriculum	.771	.102	.608	7.542	.000	.608	.608	.608

a. Dependent Variable: Academic success

The control measure in the model is statistically significant with higher standardized beta values: beta = .608; p < .005). Therefore, the high school optional curriculum predictsscience academic success.

The result was consistent with previous literature works, who argued that science high school optional curriculum level influences the science academic successof students. Therefore, hypothesis 1: *The variance on science academic success in the first year of university studies is been explained by the science high school optional curriculum*, is been supported

4.2.2. H2

The variance in science *academic success in the first year of university studies* is been explained by the *knowledge coherence*.

Table-7. Correlation outputs of the relationship between knowledge coherence and science academic success variables

Correlations			
		Academic success	**Knowledge coherence**
Pearson Correlation	Academic success	1.000	.582
	Knowledge coherence	.582	1.000
Sig. (1-tailed)	Academic success	.	.000
	Knowledge coherence	.000	.
N	Academic success	99	99
	Knowledge coherence	99	99

The outputs of the Pearson correlation indicate that there is a high positive correlation between knowledge coherence and science academic success variables, r = .582, n = 99, p < .005. The value of correlation points out that increasing knowledge coherence values would increase the science academic success level. So, there is a high positive correlation between knowledge coherence and science academic success variables.

Table-8. R Square values of the relationship between knowledge coherence and science academic success variables

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.582[a]	.338	.331	.92158	.338	49.596	1	97	.000

a. Predictors: (Constant), Knowledge coherence

The regression outputs show that the total variance of science academic success explained by knowledge coherence level is 33.8%, F (1, .921), p < .005. The other variance may be explained by other variables.

Table-9. Multivariate regression outputs of the relationship between knowledge coherence and science academic success variables

Coefficients[a]									
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	.763	.163		4.678	.000			
	Knowledge coherence	.640	.091	.582	7.042	.000	.582	.582	.582

a. Dependent Variable: Academic success

The control measure in the model is statistically significant with higher standardized beta value: beta = .582; p < .005). Therefore, knowledge coherencepredictsscience academic success.

The result was consistent with previous literature works, which argued that knowledge coherencelevel influences the science academic successof students. Therefore, hypothesis 2: *The variance on science academic success in the first year of university studies is been explained by the knowledge coherence*, is been supported

4.2.3. H3

The variance in science academic success in the first year of university studies is been explained by the science high school optional curriculum and knowledge coherence.

Table-10. R Square values of the relationship between science high school optional curriculum,knowledge coherence, and science academic success variables

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.683[a]	.466	.455	.83213	.466	41.904	2	96	.000

a. Predictors: (Constant), Knowledge coherence, High school optional curriculum

The regression outputs show that the total variance of science academic success explained by science high school optional curriculumand knowledge coherence level is 46.6%, F (1, .832), p < .005. The other variance may be explained by other variables.

Table-11. Multivariate regression outputs of the relationship between science high school optional curriculum,knowledge coherence, and science academic success variables

Coefficients[a]													
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-.031	.222		-.141	.888	-.471	.409					
	High school optional curriculum	.531	.111	.419	4.793	.000	.311	.751	.608	.439	.357	.729	1.372
	Knowledge coherence	.401	.096	.364	4.165	.000	.210	.591	.582	.391	.311	.729	1.372

a. Dependent Variable: Academic success

The control measure in the model is statistically significant with higher standardized beta values: high school optional curriculum beta = .582; knowledge coherence beta = .364; p < .005). Therefore, high school optional curriculum, as well as knowledge coherence predictsscience academic success.

The result was consistent with previous literature works, who argued that high school optional curriculum and knowledge coherence level influences the science academic successof students. Therefore, hypothesis 3: *The variance on science academic success in the first year of university studies is been explained by the science high school optional curriculum and knowledge coherence*, is been supported

5. Conclusion and Implications

The study aimed to investigate the relationship between the science high school optional curriculum, knowledge coherence, and science academic success. The prior assumption was that the science high school optional curriculum and knowledge coherence level predict students' science academic success.

The study revealed that the science high school optional curriculum affects most of the students' knowledge and skills (77.7%) at a moderate and high level. It is found that the Chemistry and Physics at the university level are characterized with more knowledge coherence (25.4%; 25.3%) with science high school optional curriculum; meanwhile, the Mathematics and Biology at the university level are characterized with less knowledge coherence (22.2%; 17.2%) with science high school optional curriculum. It is indicated that the most number of students (33.2%) are reported to have the academic success in Biology, followed by 24.2%of the that are reported to have the academic success in Physics, 23.2% of them that are reported to have the academic success in Chemistry, and 19.2% of them that are reported to have the academic success in Mathematics.

The study found a high positive correlation between science high school optional curriculum and science academic success variables (r = .608). It is revealed that the total variance of science academic success explained by science high school optional curriculum level is 37%, the other variance may be explained by other variables. The study showed that the control measure in the model is statistically significant with higher standardized beta values (.608). Therefore, the high school optional curriculum predicts science academic success.

The study indicated a high positive correlation between knowledge coherence and science academic success variables (r = .582).It is revealed that the total variance of science academic success explained by knowledge coherence level is 33.8%, the other variance may be explained by other variables. The study showed that the control measure in the model is statistically significant with a higher standardized beta value (.582). Therefore, knowledge coherence predicts science academic success.

The study found that the total variance of science academic success explained by science high school optional curriculum and knowledge coherence level is 46.6%, the other variance may be explained by other variables. It is showed that the control measure in the model is statistically significant with higher standardized beta values: high school optional curriculum beta (.582); knowledge coherence beta (.364). Therefore, high school optional curriculum, as well as knowledge coherence predicts science academic success. Therefore, the high school as well as the university departments should increase their work to support high school students, as well as first-year university students in the science academic success.

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