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Relaciones de Clase en el Sistema Universitario y su Efecto sobre el Rendimiento Académico: el Caso de Bogotá.

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Class Relations in the Higher Educational System and its Effects in Academic Performance: the Case of Bogotá.

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Abstract

The following investigation aims to present an analysis of the hierarchization of the higher educational system of Bogotá. Furthermore, in this article it is attempted to understand the distribution and concentration of the students in the universities according to their social origin inquiring for the effect of social origin differences in academic performance, specifically in the ICFES SABER PRO test. Factorial analysis models and correlation techniques were used using the statistical information of the Instituto Colombiano para la Evaluación de la Educación ICFES as source of evidence. The analysis of the collected evidences demonstrates the existence of a strong relation between the social origin and the university of destiny, generating a highly stratificated higher education system characterized by the major participation of private universities, along with a moderate relation between the social origin and the academic performance of the students.

Keywords: social stratification, social class, higher education system, academic performance

Relaciones de Clase en el Sistema Universitario y su Efecto sobre el Rendimiento Académico: el Caso de Bogotá

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Resumen

El presente artículo tiene por objeto analizar la jerarquización del sistema universitario bogotano en relación con la estructura de clases junto con la distribución y concentración de los estudiantes según su origen social en las universidades de la ciudad de Bogotá, indagando además por la relación existente entre el origen social de los estudiantes y su rendimiento académico, puntualmente en el caso de la prueba de Estado ICFES SABER PRO. Para cumplir con estos objetivos, se recurrió a técnicas de análisis factorial y análisis de correlación con información estadística proveniente del Instituto Colombiano para la Evaluación de la Educación ICFES. La evidencia analizada demuestra la existencia de una estrecha relación entre el origen social y la universidad de destino, generando un sistema universitario altamente jerarquizado y estratificado caracterizado por la participación mayoritaria de universidades de carácter privado, así como un impacto moderado del origen social en el rendimiento académico de los estudiantes.

Palabras clave: estratificación social, clase social, sistema universitario, rendimiento académico

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La expansión de la cobertura educativa en América Latina ha sido una tendencia sostenida y generalizada para todo el continente a partir del final de la década de los ochenta. Los sistemas educativos latinoamericanos han experimentado un acelerado incremento de la tasa de cobertura bruta de educación superior en los últimos cincuenta años y las instituciones universitarias han pasado de ser propiedad exclusiva para la formación de los cuadros de las élites para extenderse hasta las clases medias de las sociedades latinoamericanas.

En Colombia, la expansión masiva de la educación básica y secundaria se dio en gran medida debido a una participación mayoritaria del sector oficial en la satisfacción de la demanda nacional. En contraste con lo anterior, la ampliación de la oferta de la educación superior se ha dado gracias a una participación moderadamente mayor, pero en constante crecimiento, del sector privado (López & Moncada, 2012). Debido a esto, las posibilidades de entrada a la educación superior se encuentran estrechamente asociadas a las posibilidades económicas del aspirante o su núcleo familiar, el colegio de egreso y la trayectoria social familiar y personal. En síntesis, el sistema educativo ha experimentado una tendencia a la estratificación interna producto de su relación con el sistema de clases.

Dada esta lógica, la mayoría de las estudiantes que se matriculan en primer semestre de alguno de los programas profesionales ofertados por las universidades colombianas, provienen de colegios privados y, por ende, tienden a pertenecer a los sectores más aventajados socialmente. No pesan únicamente las diferencias asociadas al capital económico, puesto que la distribución desigual del capital cultural se reproduce y reafirma en las diferencias de clase reflejadas en el colegio de procedencia y los puntajes en pruebas de Estado (Villegas & López, 2011; López, & Moncada, 2012). Por ende, el ingreso a la educación pública se encuentra también condicionado a la posición ocupada en el sistema de estratificación social, dadas las diferencias asociadas al capital cultural reflejadas en los resultados de estas pruebas.

Si bien la participación creciente de las instituciones privadas ha propiciado una expansión cuantitativa de la oferta en educación superior que ha permitido que más personas ingresen a la universidad, también ha estimulado la creación de instituciones de baja calidad y precarias

condiciones institucionales que, dado su bajo costo, en relación a las universidades tradicionales privadas y sus mínimos requisitos de ingreso, son vistas por los miembros de las clases menos aventajadas socialmente como opciones viables. Adicionalmente, el modesto crecimiento de la oferta de educación pública ha significado que aquellos estudiantes que logran ingresar a la educación superior, provenientes de las clases sociales menos aventajadas socialmente, por vías de instituciones privadas, dependan enormemente de sus ingresos o de la adquisición de créditos; lo cual, genera un peso significativo tanto para ellos, como para sus familias (Domina, Conley, & Farkas, 2011).

Teniendo en cuenta que el acceso a la educación superior permite el desarrollo de capacidades específicas de vital importancia para el funcionamiento del mercado laboral, el desarrollo nacional y la realización individual de las personas que optan por adelantar estudios universitarios, es importante, desde el punto de vista sociológico, entender la distribución de las diferentes clases sociales en las universidades que componen el sistema universitario. Habiendo dicho lo anterior, la presente investigación tiene por analizar la jerarquización del sistema universitario bogotano en relación con la estructura de clases junto con la distribución y concentración de los estudiantes según su origen social en las universidades de la ciudad de Bogotá, indagando además por la relación existente entre el origen social de los estudiantes y su rendimiento académico, puntualmente en el caso de la prueba de Estado ICFES SABER PRO.

Método

Población y Muestra

La población definida como objeto de estudio fueron los estudiantes de programas profesionales de las Instituciones de Educación Superior (IES) de la ciudad de Bogotá. Para efectos de contar con los datos necesarios para adelantar esta investigación, se contactó al ICFES para solicitar información estadística actualizada referente a este grupo poblacional. La base de datos entregada por el ICFES contiene registros de todos los estudiantes que presentaron la prueba SABER PRO en ambos semestres del

año 2016 a nivel nacional. La prueba ICFES SABER PRO es un examen clasificatorio realizado por el Instituto Colombiano para la Evaluación de la Educación dirigido a todos los estudiantes de programas universitarios de pregrado y licenciaturas en Colombia cuya presentación constituye un requisito necesario para egresar de un programa universitario. La primera parte de la prueba consta de un cuestionario de competencias generales aplicado a todos los estudiantes de manera general, la segunda parte incluye una evaluación especifica según la formación profesional del estudiante.

Es decir, la base de datos disponible cuenta con la información de todos los estudiantes que culminaron sus estudios de bachillerato y posteriormente culminaron sus estudios universitarios en el año 2016. Para los años 2017 y 2018 no existían bases de datos anonimizadas de las mismas características según fue informado por el ICFES; por lo cual, se trabajó con la información del último año actualizado. En total, la base consta de 46524 registros, donde cada registro corresponde a un estudiante y donde se recopiló tanto información de carácter sociodemográfico como el puntaje en los núcleos de evaluación de las pruebas SABER PRO para cada uno de los estudiantes pertenecientes a 69 universidades de la ciudad.

Procedimiento de Recogida y Análisis de Datos

A partir de la base de datos unificada, se clasificó a los estudiantes universitarios mediante la construcción de una escala denominada escala de origen social elaborada a partir de la información socio demográfica solicitada al ICFES a cada estudiante a la hora de presentar tanto la prueba SABER PRO. La escala de origen social fue elaborada con la pretensión de generar un indicador eficiente que agrupara la información de interés sociológico consignada en la base de datos unificada de manera integral, tanto en términos métricos como conceptuales utilizando el análisis factorial. La finalidad de las diversas técnicas agrupadas bajo el nombre de análisis factorial es determinar un número k de variables subyacentes, denominadas factores, a partir de una serie n de variables observadas siendo $n < k$.

Para tales efectos, las técnicas de análisis factorial reducen la estructura de las variables observadas modelándolas como combinaciones lineales de

los factores obtenidos incluyendo medidas de error; es decir, en términos generales los diversos tipos de análisis factorial pueden catalogarse como técnicas de reducción de datos. Para la elaboración de la escala, se recurrió al análisis de componentes principales (PCA). El PCA ordena los componentes o factores modelados en función de la cantidad de la varianza original explicada; en otras palabras, el PCA busca la proyección que mejor represente a los datos originales en términos de mínimos cuadrados. Los diversos tipos de análisis factorial y en general de técnicas de reducción de dimensiones tienen un amplio historial de uso en la investigación social (Bialowlski, 2015; Mishra, 2016).

   Las variables incluidas en el modelo fueron el estrato socioeconómico, el máximo nivel educativo alcanzado por el padre, el máximo nivel educativo alcanzado por la madre, el número de horas que el estudiante trabajó a la semana, si los padres pagaron los estudios del estudiante o no, el valor de la matrícula pagada a la universidad, la jornada del colegio y si el colegio era o no bilingüe. Las variables "pagó sus estudios con crédito" "ocupación del padre" y "ocupación de la madre" fueron excluidos del modelo final en tanto su nivel de significación no resultó considerable, probablemente debido a deficiencias en su tipificación, siendo esta observación bastante probable para el caso de la ocupación del padre y la madre, dado que si bien la bibliografía existente y la teoría sociológica adjudican una influencia importante tanto a los niveles de cualificación de los padres como a sus respectivas ocupaciones como factores explicativos de la trayectoria social de un individuo, la tipificación de las ocupaciones en las bases de datos se reducía a cinco categorías extremadamente generales. La aplicación del PCA permitió reducir la estructura de los datos a un solo factor que explica el 55% de la varianza y cuya prueba de esfericidad dio como resultado 0.871 siendo posible utilizar el modelo con fines explicativos dado que cumple con los criterios necesarios de calidad estadística tal y como se muestra a continuación (Tabla 1 y Tabla 2).

Tabla 1:
Varianza explicada del modelo origen social

| Componente | Autovalores iniciales | | | Sumas de extracción de cargas al cuadrado | | |
	Total	% de varianza	% acumulado	Total	% de varianza	% acumulado
1	3,064	55,766	55,766	3,064	55,766	55,766
2	,937	13,390	69,157			
3	,780	11,139	80,295			
4	,734	10,487	90,783			
5	,652	9,119	99,902			
Método de extracción: análisis de componentes principales. (PCA)						

Fuente: elaboración propia

Tabla 2:
Comunalidades modelo origen social y ecuación matricial.

Comunalidades del modelo origen social

Variables	Inicial	Extracción
Valor de la matrícula	1,000	0,492
Estrato socioeconomic	1,000	0,608
¿Fue la matrícula pagada por los padres?	1,000	0,390
Nivel de escolaridad máximo alcanzado por la madre	1,000	0,574
Nivel de escolaridad máximo alcanzado por el padre	1,000	0,563
¿Es el colegio billingue?	1,000	0,329
Jornada del colegio	1,000	0,307
Número de horas que trabaja a la semana	1,000	0,457

Fuente: elaboración propia

Posteriormente, a partir de la matriz de coeficientes factoriales, se calcularon las puntuaciones factoriales del factor para cada individuo mediante la siguiente ecuación matricial:

$$PF = A^T(AA^T)^{-1}$$

Donde A es la matriz de coeficientes factoriales y A^T es la traspuesta de esta matriz. Esta ecuación matricial da como resultado el vector PF de 1x46524 donde cada ***i-ésima*** fila del vector PF corresponde a la puntuación factorial del ***i-ésimo*** individuo de la base de datos. Finalmente, se sumó a cada una de las puntuaciones factoriales obtenidas para cada estudiante el rango de las puntuaciones factoriales originales con el fin de generar un indicador más fácil de interpretar sin ninguna pérdida de proporcionalidad, logrando así clasificar a cada individuo de la población estudiada a partir de un único valor entre 1 y 8, donde el valor mínimo indica que el origen social del individuo es socialmente poco aventajado, en tanto pertenece a un estrato socioeconómico bajo, los niveles de educación máximos alcanzados por los padres son precarios, trabaja un número elevado de horas al mes, costeó sus propios estudios, paga matrículas de menor valor, y cursó sus estudios en un colegio no bilingüe y de jornada a tiempo parcial, siendo el caso opuesto para aquellos individuos con la puntuación máxima en la escala de origen social. La lectura en términos generales de la escala de origen social es sencilla y puede interpretarse como: *a mayor puntuación, más aventajado socialmente es el origen social del individuo*.

El mismo procedimiento descrito previamente fue utilizado para catalogar a los individuos en función de su rendimiento en la prueba de Estado ICFES SABER PRO utilizando como variables las calificaciones obtenidas por los estudiantes en el núcleo básico de ambas pruebas y en el módulo de segundo idioma. A partir de lo anterior, se construyó la escala " rendimiento en la prueba SABER PRO" donde a cada individuo se le asignó un único valor entre 0 y 8. La interpretación de esta escala es análoga a la de la escala de origen social y puede interpretarse como: *a mayor puntuación, mejor fue el desempeño del estudiante en la prueba*.

Posteriormente, se clasificaron jerárquicamente a las 69 instituciones de educación superior analizadas utilizando la escala de origen social y las escalas de rendimiento en las pruebas de estado. La jerarquización fue realizada utilizando la media de las puntuaciones obtenidas por los individuos en cada una de las tres escalas para cada universidad, ordenando los resultados de menor a mayor siendo la universidad ubicada en la

primera posición aquella cuyos estudiantes, en promedio tienen las puntuaciones más bajas en la escala analizada mientras que la universidad número 69 es aquella en donde en promedio, los estudiantes tienen las puntuaciones más altas en la escala analizada.

Para el caso de la clasificación de las universidades realizada en función de la escala de origen social, la interpretación es como sigue: *a mayor puntuación promedio, más aventajados socialmente son los estudiantes pertenecientes a la universidad analizada*. Para el caso de la clasificación realizada en función de las escalas de rendimiento en pruebas de Estado, la interpretación es análoga: *a mayor puntuación promedio, los resultados de los estudiantes pertenecientes a la universidad analizada fueron mejores*.

Resultados

La Jerarquización del Sistema Universitario Bogotano

En términos generales, la estructura del sistema universitario se caracteriza por la existencia de una marcada diferenciación de las universidades en función del origen social de los estudiantes, lo cual tiende a generar que determinada universidad se encuentre asociada mayoritariamente a una clase social en particular. Tal fenómeno se manifiesta también expresamente en la educación básica y secundaria (Villegas & López, 2011), en la identificación de ciertas zonas de la ciudad con orígenes sociales particulares (Uribe & Pardo, 2006) y en hábitos de consumo culturales y formas de expresión cultural (Uribe, 2008). En suma, la estratificación del sistema universitario en función de las jerarquías propias de la estructura de clases es una de las múltiples dimensiones relativas a la inequidad que experimenta en general la ciudad de Bogotá.

El análisis de la distribución de las puntuaciones promedio de la escala de origen social, así como de las proporciones presentadas de los grupos sociales en cada una de las universidades permite concluir que el sistema universitario bogotano se encuentra altamente jerarquizado y tiende a expresar las brechas existentes en la estructura de clases de la ciudad, en consonancia con los postulados de la teoría de la reproducción y las investigaciones empíricas referidas al contexto continental, donde la

estratificación endógena del sistema educativo tiende a representar la distancia social presente en el sistema de estratificación social de las sociedades latinoamericanas (Buchmann & Hannun, 2001). A continuación, se presente el comportamiento de las puntuaciones promedio de la escala de origen social junto con la variación y la proporción de grupos presente en cada universidad (Tabla 3):

Tabla 3:
Comportamiento de las puntuaciones promedio de la escala de origen social

Puntuación promedio en la escala de origen social de cada universidad			Distribución del origen social por grupos en cada Universidad			Coeficiente de variación por universidad
Posición	Universidad	Puntuación promedio	Baja	Media	Alta	Puntuación
1	CENDA	4,3	57,3	45,3	0,0	17,0
2	Pedagógica	4,4	54,6	45,7	0,2	17,0
3	San José	4,5	50,4	52,6	0,0	15,8
4	San Mateo	4,5	48,8	52,5	0,0	15,5
5	Unilatina	4,5	51,4	51,4	0,0	19,3
6	Universitaria de Colombia	4,5	48,5	52,8	1,6	21,8
7	CUN	4,6	46,6	53,7	0,0	19,0
8	Iberoamericana	4,6	46,5	55,4	0,3	19,5
9	IDEAS	4,6	50,0	50,0	0,0	16,9
10	Monserrate	4,6	40,2	60,3	0,5	15,3
11	UNINPAHU	4,6	44,0	54,0	2,5	19,0
12	Unirepublicana	4,6	46,0	56,5	0,4	16,5
13	Universidad distrital	4,6	47,8	52,2	0,5	18,3
14	Área Andina	4,7	40,0	60,0	0,9	16,2
15	Colegio Mayor de Cundinamarca	4,7	41,2	59,0	0,2	15,4
16	ESAP	4,7	36,5	62,8	0,7	16,7
17	ETITC	4,7	44,1	54,4	2,9	18,0
18	TEINCO	4,7	48,5	51,5	1,0	16,9
19	Uniminuto	4,7	35,6	64,0	0,6	15,2

Tabla 3 – *Cont*.:
Comportamiento de las puntuaciones promedio de la escala de origen social

	Puntuación promedio en la escala de origen social de cada universidad		Distribución del origen social por grupos en cada Universidad			Coeficiente de variación por universidad
Posición	Universidad	Puntuación promedio	Baja	Media	Alta	Puntuación
20	Dirección Nacional de Escuelas (Policía)	4,8	31,3	67,3	1,4	16,3
21	INCCA	4,8	36,6	61,1	2,4	15,2
22	Uniagustiniana	4,8	32,0	68,0	0,5	17,7
23	Uniciencia	4,8	35,7	64,3	0,0	16,5
24	Unipanamericana	4,8	34,3	65,9	0,8	14,7
25	Cooperativa	4,9	29,5	70,4	0,7	15,1
26	ECCI	4,9	27,3	72,1	1,1	16,6
27	Gran Colombia	4,9	27,4	71,9	1,3	15,3
28	UNICA	4,9	37,5	58,9	3,6	15,9
29	Antonio Nariño	5	25,3	71,1	3,9	15,1
30	Autónoma	5	23,3	75,3	1,4	15,6
31	Los Libertadores	5	25,2	74,0	1,0	15,0
32	Escuela de cadetes José María Córdova	5,1	22,9	75,3	1,8	19,3
33	Uniagraria	5,1	21,7	76,1	2,2	17,4
34	Unicervantina	5,1	26,5	69,9	4,8	14,3
35	Universidad Nacional (sede Bogotá)	5,1	26,1	69,5	4,6	15,3
36	UNITEC	5,2	19,3	76,9	4,2	15,5
37	Cafám	5,3	13,8	84,0	2,1	14,9
38	Católica	5,3	13,8	82,4	4,0	14,3
39	Escuela de Artes y Letras	5,3	15,6	81,6	3,3	15,6
40	Manuela Beltrán	5,3	13,7	83,0	3,5	13,5
41	UDCA	5,3	16,4	76,1	7,4	12,6
42	Escuela Colombiana de Rehabilitación	5,4	10,5	87,2	2,3	13,6

Tabla 3 – *Cont*.:
Comportamiento de las puntuaciones promedio de la escala de origen social

Puntuación promedio en la escala de origen social de cada universidad			Distribución del origen social por grupos en cada Universidad			Coeficiente de variación por universidad
Posición	Universidad	Puntuación promedio	Baja	Media	Alta	Puntuación
43	La Salle	5,4	12,2	82,5	5,4	13,9
44	Politécnico Gran Colombian0	5,4	15,3	75,1	9,6	13,7
45	San Martín	5,4	12,1	80,9	6,9	15,8
46	Universidad Central	5,4	12,8	82,7	4,5	13,5
47	Universidad de la Cámara de Comercio	5,4	11,4	86,1	2,4	14,1
48	Universidad Libre	5,4	11,2	82,1	6,7	12,2
49	Konrad Lorenz	5,5	7,9	85,2	7,4	14,9
50	UNICOC	5,5	10,6	78,8	10,6	13,0
51	San Buenaventura	5,6	8,2	77,5	14,7	13,3
52	Santo Tomás	5,6	7,3	82,9	9,8	15,0
53	Universidad Militar	5,6	7,3	81,9	10,9	12,9
54	América	5,7	5,4	86,4	8,2	14,0
55	FUCS	5,7	12,2	62,2	25,6	11,6
56	Piloto	5,7	7,6	77,0	15,5	16,4
57	Unisánitas	5,8	11,5	56,2	33,1	17,3
58	EAN	5,9	3,8	73,6	22,6	13,2
59	El Bosque	5,9	4,7	71,4	24,0	12,8
60	Escuela de Ingenieros	5,9	3,6	72,2	24,2	12,5
61	Jorge Tadeo Lozano	5,9	4,4	73,5	22,0	13,3
62	Corpas	6	2,5	68,6	28,9	11,6

Tabla 3 – *Cont*.:
Comportamiento de las puntuaciones promedio de la escala de origen social

Puntuación promedio en la escala de origen social de cada universidad			Distribución del origen social por grupos en cada Universidad			Coeficiente de variación por universidad
Posición	Universidad	Puntuación promedio	Baja	Media	Alta	Puntuación
63	Sergio Arboleda	6,2	3,2	62,4	34,5	11,8
64	Externado	6,3	1,9	58,2	39,8	11,2
65	Javeriana	6,4	0,9	45,9	53,2	9,8
66	La Sabana	6,5	0,5	44,8	54,6	9,9
67	Rosario	6,5	0,5	39,6	60,0	9,8
68	Los Andes	6,7	0,3	26,6	73,1	7,6
69	CESA	7,1	0,6	9,0	90,4	6,6

Al analizar la variación de los grupos sociales al interior de las universidades analizadas, se ha encontrado que las universidades cuya proporción de estudiantes pertenecientes al grupo social alto es mayor, tienden a presentar una menor diversidad en términos del origen social. El $R^2 = 0.58$ ilustra la existencia de una relación considerable entre el origen social promedio de los estudiantes y la variación de los grupos sociales existente al interior de la institución. En concordancia con lo anterior, la dirección del R de Pearson= -0.84 indica que, a mayor origen social promedio, se presenta menor variación con relación a los grupos sociales de la universidad. Dicho de otro modo, las universidades con puntuaciones promedio más altas en la escala de origen social y con una mayor proporción de estudiantes provenientes del grupo social alto, tienden a presentar mayor homogeneidad en lo que respecta al origen social de sus estudiantes; es decir, tienden a ser instituciones monoclasistas (Gráfico 1).
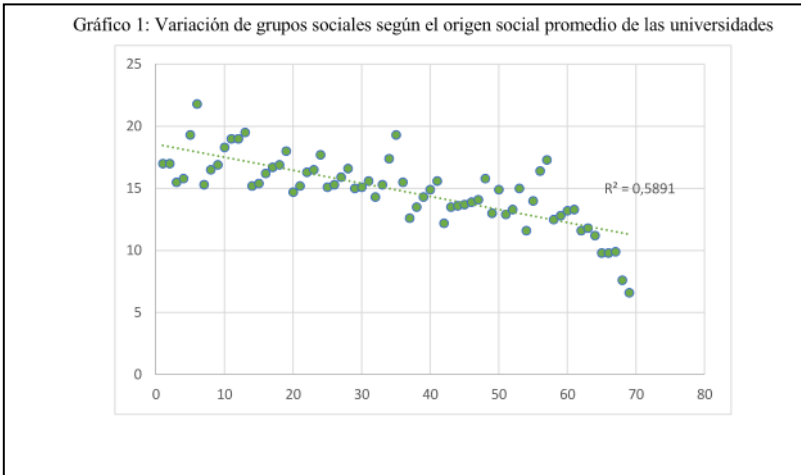
Figura 1. Variación de grupos sociales según el origen social promedio de las universidades.

La distribución monoclasista de la estructura de clases en el sistema universitario tiene una estrecha relación con la política en materia de educación adoptada por un Estado y por las características propias de las universidades (Díaz, 2012; Smith & Hauser 2017). En términos puntuales, los sistemas universitarios que presentan una proporción considerable de universidades privadas, donde la demanda de educación es atendida mayoritariamente por este tipo de instituciones y que se encuentran regidos por políticas educativas dirigidas a financiar la demanda, tienden a estratificarse de manera más jerarquizada y monoclasista en comparación a sistemas universitarios donde las universidades públicas tienen una mayor participación y donde el subsidio a la oferta es la política dominante (Smith & Hauser, 2017); panorama que resulta acorde con las dinámicas propias del sistema universitario bogotano y en términos generales, con la política de educación superior del Estado colombiano.

Paralelamente, la jerarquización del sistema universitario bogotano opera como un mecanismo efectivo de restricción de oportunidades y diferenciación de las trayectorias sociales de los estudiantes: las diferencias

socioeconómicas preexistentes entre los estudiantes, determinan las posibilidades que tienen de ingresar a determinadas universidades; además, la alta jerarquización del sistema universitario de la ciudad, producto del influjo que tienen en su configuración las brechas existentes en la estructura de clases, levantan restricciones con respecto al espectro de elección de los estudiantes, institucionalizando la segmentación de trayectorias sociales en relación al origen social individual, jerarquizando la totalidad del sistema universitario.

Lo anterior produce la composición monoclasista evidenciada a través del examen de la evidencia empírica presentada, que no es únicamente un rasgo estructural del sistema universitario, sino condiciona también la trayectoria social futura del estudiante, en tanto la jerarquización monoclasista del sistema universitario, implica que el efecto de agregación que resulta en la devaluación del valor de los títulos académicos en el mercado afecta fundamentalmente a quienes poseen títulos de las universidades ubicadas en la base de la estructura del sistema universitario.

El incremento del monoclasismo a medida que aumentan las puntuaciones promedio en la escala de origen social y la proporción del grupo social alto en las universidades, pone de manifiesto la manera en la que la ampliación de la cobertura ha consistido en igualar por lo bajo el acceso a la educación superior; es decir, ampliar la cobertura universitaria mediante la participación de universidades privadas de baja calidad dirigidas a atender la demanda de los estudiantes de orígenes sociales menos aventajados, fenómeno característico de los sistemas educativos latinoamericanos que incrementaron su cobertura en educación superior masivamente en las últimas dos décadas y con una participación creciente del sector privado.

Adicionalmente, la jerarquización del sistema universitario y su monoclasismo característico afecta necesariamente el proceso de reproducción ampliada de la fuerza de trabajo y tiende a reforzar los mecanismos de dominación característicos de las economías de mercado: la diferenciación de las trayectorias sociales y la institucionalización de las jerarquías en el sistema universitario, determinan en parte la posición que los individuos ocupan en los procesos de producción y gestión del capital (Sørensen, 2000; Wright, 2015). Por ende, el hecho de que las posiciones de

poder estén ocupadas por individuos con trayectorias sociales similares y en particular, por personas que provienen de las mismas universidades, tiene relación con la reproducción de las posiciones de la estructura de clases a través del sistema educativo, así como las correspondientes restricciones en materia de acceso dadas las diferencias preexistentes asociadas al origen social.

La estructura del sistema educativo bogotano, revela el hecho de que las universidades de mayor tradición y calidad, continúan estando asociadas a las clases sociales más aventajadas, a excepción de las universidades públicas, que tienden a reducir la intensidad de la relación existente entre origen social y universidad de destino, si bien esta relación no desaparece totalmente. Tal comportamiento resulta ser, según los resultados obtenidos en la presente investigación el elemento central de las dinámicas de estratificación del sistema universitario bogotano, en concordancia con la investigación empírica referente a fenómenos similares al aquí estudiado (Dorius, 2011; Montt, 2014; Levy & Schady ,2013; López & Moncada, 2012).

El Rendimiento Académico y el Origen Social

A la luz de los resultados obtenidos, puede afirmarse que existe una relación estrecha entre el rendimiento académico, medido a través de los resultados de la prueba SABER PRO y la distribución de la estructura de clases en las universidades examinadas. Empíricamente hablando, se ha comprobado que entre más bajo sea el puntaje promedio en la escala social para una universidad, menor es su rendimiento promedio en la prueba SABER PRO. La distribución jerárquica del rendimiento educativo en función del origen social promedio de determinada universidad, es un resultado concluyente en relación a los aportes de la teoría de la reproducción social, dado que, en términos generales, las diferencias referentes al capital cultural asociadas a la posición en la estructura de clases, tienden a expresarse y reafirmarse en el sistema universitario bogotano y no a reducirse e igualarse, tal y como lo afirman investigaciones empíricas que han analizado relaciones similares para el caso universitario

(Cuenca, 2016; Cavanagh & Fomby, 2012) y para el caso de la educación secundaria (Villegas & López, 2011; López. & Moncada, 2012).

Sin embargo, si bien la estructura del sistema universitario tiende a moldearse en función de las diferencias de clase, el rendimiento educativo se encuentra relacionado con el origen social de manera más preponderante en las universidades privadas, mientras que en las universidades públicas el efecto del origen social en el rendimiento académico tiende a aminorarse. Al clasificar las 69 universidades de menor a mayor según el puntaje promedio en la escala de origen social para evaluar el rendimiento en la prueba SABER PRO, el R2 = 0.44 indica una asociación moderada entre el rendimiento y la universidad, tal y como se muestra a continuación (Gráfico 2 y Gráfico 3):
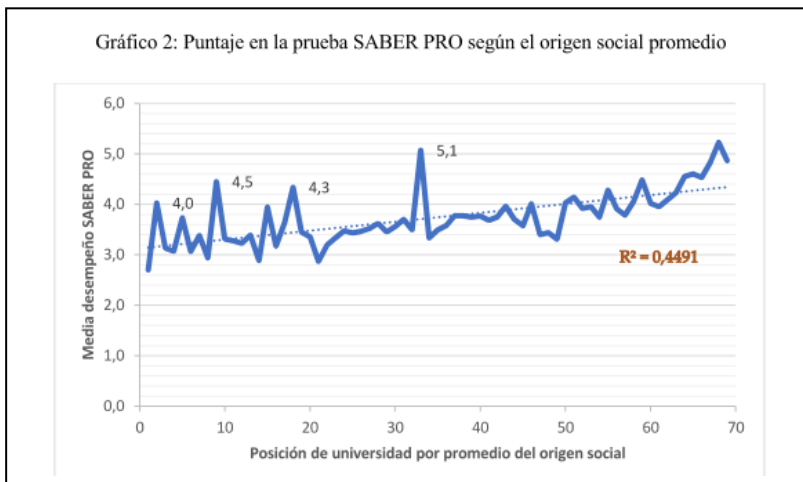

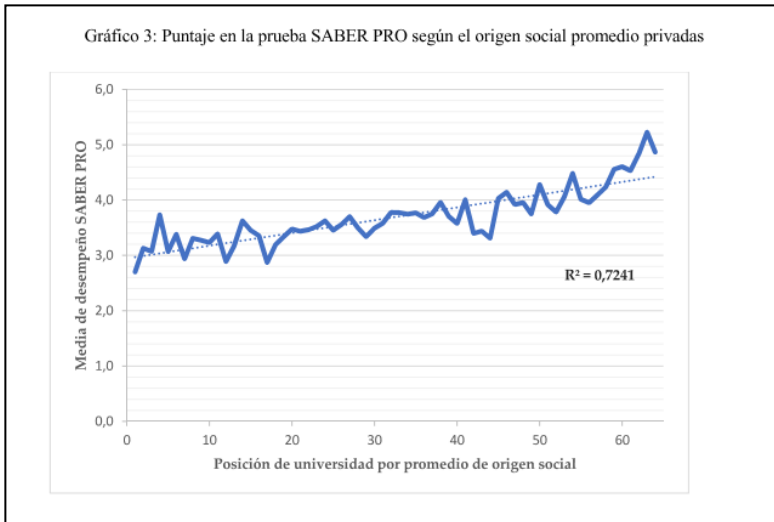*Figura 2.* Puntaje en la prueba SABER PRO según el origen social promedio.

Figura. Puntaje en la prueba SABER PRO según el origen social promedio privadas.

Analíticamente hablando, la jerarquización del sistema educativo es uno de los múltiples mecanismos presentes en las sociedades contemporáneas cuya finalidad es la restricción y diferenciación de posiciones y, por consiguiente, de oportunidades. La mayor participación que tienen hoy por hoy las instituciones privadas de educación superior en la ciudad de Bogotá, implica que la dinámica del sistema universitario tienda a funcionar bajo la lógica de la libre competencia; por lo cual, el peso que tienen los recursos propios de los estudiantes o su capacidad de endeudamiento, tiene una injerencia directa en la estructura jerárquica del sistema universitario (Cavanagh, & Fomby, 2012; Houle, 2014).

Tal dinámica, necesariamente condiciona la venta de oportunidades disponibles para los estudiantes, en tanto la escogencia de determinada universidad se encuentra ligada a su capacidad de pago y termina por estratificar el sistema universitario de la ciudad. Así mismo, la diferencia del valor de la matrícula entre las universidades privadas, obedece principalmente a las ventajas comparativas que cada universidad ofrece en

materia de equipamiento, cualificación profesional del cuerpo docente y reputación de la institución, entre otros factores (Domina, Conley, & Farkas, 2011) es decir, en términos generales a la eficacia del diseño institucional de la universidad para garantizar posiciones ventajosas a través del proceso de reproducción ampliada de la fuerza de trabajo.

Por ende, para el caso bogotano, la estratificación del sistema universitario en función de la capacidad de pago o endeudamiento de sus estudiantes implica que los estudiantes con recursos más modestos tenderán a entrar a universidades de menor costo y, por ende, peor dotadas institucionalmente lo cual tiene efectos directos en el rendimiento académico (Cuenca, 2016; Forste, Heaton & Haas, D, 2014). En contraste con lo anterior, el diseño institucional de las universidades públicas, así como sus condiciones de funcionamiento, no están sujetas de manera tan rígida al funcionamiento del mercado universitario; por lo cual, la universidad pública tiene una mayor capacidad de recepción de estudiantes de orígenes sociales diversos quienes al ingresar a las universidades públicas, tienen la posibilidad de formarse bajo criterios de alta calidad académica independientemente de la capacidad de pago que tengan.

En concordancia con los resultados obtenidos, no puede entenderse al sistema universitario en su conjunto como un mecanismo cuyo único efecto es la reproducción de la desigualdad ni tampoco como un mecanismo totalmente efectivo de movilidad social ascendente. El desempeño en la prueba SABER PRO en las universidades públicas, muestra una relativa independencia con respecto al origen social de los estudiantes y, por ende, es plausible afirmar que la universidad pública tiene un efecto de igualación del capital cultural de los estudiantes, así como una composición moderadamente policlasista. Sin embargo, la jerarquización del sistema universitario en función de la estructura de clases sigue siendo el rasgo más evidente del sistema como tal, incluso considerando el efecto de las universidades públicas y pese a aminorarse, la relación entre origen social y desempeño académico perdura, aunque con menor intensidad en comparación a las instituciones privadas, en las universidades públicas, particularmente en el caso de la Universidad Nacional.

Paralelamente, son las instituciones privadas de menor calidad educativa, un cuerpo docente más modestamente preparado y de menor

costo, donde se evidencian los resultados más bajos en la prueba SABER PRO. Por ende, el refuerzo del mecanismo de restricción de oportunidades en el sistema universitario, se da gracias a la participación mayoritaria que tienen las universidades de carácter privado en la oferta educativa de la ciudad. Es en las universidades privadas en las que existe una relación estrecha entre el origen social y las diversas ventajas institucionales de las universidades.

Adicionalmente, si bien el análisis del efecto de la educación secundaria en la trayectoria universitaria y laboral de los estudiantes sobrepasa las posibilidades de esta investigación, la evidencia empírica existente respalda la aseveración de que la distribución de la estructura de clases en el sistema educativo secundario tiende a reafirmarse en el sistema universitario (Smith, & Hauser, 2017;Roderick, Coca & Nagakoa, 2011). Para el caso de Bogotá, ha podido comprobarse que los resultados en los exámenes de Estado están estrechamente relacionados al carácter público o privado del colegio y, por consiguiente, al origen social de los estudiantes (Villegas & López, 2011; López, & Moncada, 2012); por ende, las diferencias asociadas al rendimiento educativo en la universidad son por lo general explicadas como producto de la reproducción de las diferencias preexistentes en la etapa escolar.

Sin embargo, la disminución de la influencia del origen social en el rendimiento en la prueba SABER PRO para el caso de las universidades públicas evidenciada en esta investigación, pone de manifiesto la necesidad de matizar el alcance que tiene la inequidad relativa al capital cultural institucionalizado e internalizado preexistente en el sistema de educación secundario, como factor explicativo principal de la dinámica de estratificación del sistema universitario, tanto en términos estrictamente empíricos, como lo es el caso del estudio del sistema universitario bogotano, como también a un nivel teórico general.

Discusión y Conclusiones

La baja regionalización de la matrícula en el país producto de la falta de oferta en educación superior de calidad en las regiones, sumado a la excesiva carga económica que tienen los hogares colombianos en la

financiación de los estudios universitarios y al considerablemente bajo gasto por estudiante realizado por el Estado colombiano, hacen que el acceso y la permanencia en la universidad se dificulte considerablemente para los estudiantes provenientes de las clases sociales menos aventajadas.

Aunado a lo anterior, la aplicación de políticas encaminadas a la financiación de la demanda y la institucionalización del crédito como política educativa principal para permitir el acceso a la educación superior, han hecho que una creciente proporción de la demanda de educación superior se satisfaga a partir de una mayor participación del sector privado, lo cual ha permitido la emergencia de instituciones de baja calidad académica, cuyo estudiantado se encuentra constituido mayoritariamente por estudiantes provenientes de las clases menos aventajadas socialmente.

En este sentido, los resultados referentes al estudio puntual del sistema universitario bogotano, revelan la existencia de una considerable jerarquización anclada a las diferencias de clase de los estudiantes de la ciudad, verificando por tanto la hipótesis de que la jerarquización del sistema universitario bogotano se encuentra estrechamente ligada a la estructura de clases. Además, al ascender en la estructura de clases, las universidades con una mayor proporción de estudiantes provenientes de las clases sociales más aventajadas presentan una mayor tendencia al monoclasismo. Por lo tanto, el sistema universitario opera como un mecanismo de restricción de oportunidades altamente diferenciado en función del origen social, lo cual termina por reproducir el hermetismo social y la inequidad.

Las universidades de mayor tradición y calidad de la ciudad se encuentran aún reservadas para miembros de las clases altas y medias, y son estas instituciones las que presentan mayores niveles de monoclasismo; sin embargo el papel que juega la universidad pública en aminorar la intensidad de la relación existente entre el origen social y la estructura del sistema educativo es considerable, pues pese a la participación creciente de las instituciones privadas, las universidades públicas tienen una mayor capacidad de inclusión y una composición más plural en términos de clase.

El rol que juegan las universidades públicas en la atenuación de las diferencias de clase se hace explícito al analizar el efecto del origen social en el rendimiento académico, puntualmente en la prueba SABER PRO. Si

bien el efecto del origen social no desaparece totalmente, en las universidades públicas se evidencia una independencia considerable en el rendimiento en esta prueba con respecto al origen social, mientras que, en las universidades privadas, la relación es ostensiblemente estrecha.

Más aún, los estudiantes de universidades públicas tienen en promedio, un mejor rendimiento en esta prueba que la mayoría de estudiantes de las universidades privadas; por lo cual, no puede afirmarse que el desempeño en la prueba ICFES SABER PRO esté asociado al origen social de los estudiantes de las universidades estudiadas con total cabalidad, dado que si bien esta relación es considerablemente evidente en las universidades privadas, en las universidades públicas el efecto tiende a controlarse.

Agendas investigativas dirigidas a trabajar sobre hipótesis relativas al diseño institucional de las universidades como factores explicativos de las diferencias en el rendimiento académico, asociadas a la distribución de la estructura de clases en el sistema educativo, así como mediciones más eficientes del rendimiento académico, pueden ayudar a esclarecer las causas por las cuales la universidad pública aminora las diferencias en el rendimiento académico asociadas al origen social que se manifiestan con considerable intensidad en las universidades privadas de la ciudad.

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Group-Based Assignments: Member Reactions to Social Loafers

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Abstract

Understanding how student teachers undertake their group work may provide a solid foundation for developing essential skills required for the 21st Century teachers, and subsequently help improve group-based assessment in higher education. However, social loafing has been found to interfere with this assessment mode. This article reports on undergraduate student teachers' processes involved in doing group-based assignments amid the existence of social loafing tendencies amongst group members. It focuses on how students organize themselves in doing the work and their reactions to social loafers. The data were collected using semi-structured interviews involving 18 purposefully and conveniently selected participants from Mkwawa University College of Education in Tanzania. The findings indicated procedures that students observe in doing their group assignments such as the formulation of own group norms and rules. Additionally, it was found that group members employed humanitarian, punitive and threatening approaches as they reacted to social loafers. The article concludes that proper planning for students' group assignments is important, in which both instructors and students should play their roles accordingly to overcome the problem of social loafing when the use of group-based assessments is indispensable within higher education contexts.

Distribución de Tareas en Grupo: Reacciones a los Holgazanes Sociales

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Resumen

Comprender cómo los estudiantes de profesorado realizan su trabajo en grupo puede proporcionar una base sólida para desarrollar las habilidades esenciales requeridas para los maestros del Siglo XXI y ayudar a mejorar la evaluación grupal en la educación superior. Sin embargo, la actividad social interfiere con este modo de evaluación. Este artículo informa sobre los procesos de estudiantes de profesorado de pregrado en la realización de tareas grupales en medio de la existencia de tendencias sociales entre los miembros del grupo. Se centra en cómo los estudiantes se organizan para hacer el trabajo y sus reacciones ante los holgazanes sociales. Los datos recopilados por entrevistas semiestructuradas incluyeron a 18 participantes de Mkwawa University College of Education en Tanzania seleccionados a propósito y convenientemente seleccionados. Los resultados indicaron los procedimientos que los estudiantes observan al realizar sus tareas grupales, como la formulación de normas y reglas propias del grupo. Además, se encontró que los miembros del grupo empleaban enfoques humanitarios, punitivos y amenazadores cuando reaccionaban ante los holgazanes sociales. En conclusión: en las asignaciones grupales de los estudiantes es importante que instructores y estudiantes desempeñen sus roles para superar los problemas.

Palabras clave: asignación de grupos, educación superior, reacciones de los miembros, actividades sociales, teoría del intercambio social

Understanding how student teachers carry out their group assignments as part of their continuous assessment can be an essential step in efforts to improve assessment practices within higher education (HE) contexts. It is considered an important step because the use of group work has been found to shoulder different challenges besides its potential benefits being documented in the empirical as well as theoretical literature. From the literature, it is learned that the use of group work has been emphasized for various reasons as part of continuous assessment in HE. Specially, the benefits associated with the use of group work include its ability to promote collaborative learning skills among students (Hassanien, 2006), as well as enhancing students' academic achievement and socialization (Frykedal & Chiriac, 2011). It also improves task performance and the development of learners' critical thinking skills (Petty, 2009). Indeed, the use of group work is also considered an effective strategy in addressing diversity issues in education provision (Morgan, 2004; Opdecam & Everaert, 2018). Certainly, the use of group work is believed to facilitate the development of some of the skills and competences being emphasized as important in the 21st Century (Geisinger, 2016; Kereluik, Mishra, Fahnoe & Terry, 2013; Mishra & Mehta, 2017).

Despite the potential benefits of using group work in education, working in groups is not always a rewarding experience especially when justice (that is, distributive, procedural, and transactional) is not observed when students engage in group assignments (Baron & Branscombe, 2012). One of the dark sides of working in groups amongst students is the existence of social loafing and/or free-riding tendencies (Davies, 2009; Gaur & Gupta, 2013; Opdecam & Everaert, 2018), and certainly leading to conflicts (LaBeouf, Griffith & Roberts, 2016). Further empirical evidence indicates that working in group situations is a stressful experience to some students especially the active team members (Hall & Buzwell, 2012; Livingstone & Lynch, 2000), partly because of social loafing phenomenon.

Conceptually, social loafing is a situation whereby individuals withdraw their efforts while working in group situations compared to when they work alone and rely on other group members to have the work done, while expecting to benefit equally on the performance outcomes (Baron & Branscombe, 2012; Horowitz & Bordens, 1995; Jassawalla, Malshe &

Sashittal, 2008; Njie, Asimiran & Basri, 2013; Webb, 1995); those displaying the behavior are referred to as social loafers. As a result, the literature is replete with negative consequences associated with the occurrence of social loafing when individuals work in groups in different contexts (Cheng & Warren, 2000; Latane, Williams & Harkins, 1979). It is observed that, the interest in the study of social loafing has even been extended to assessment practices especially in higher education contexts (Hall & Buzwell, 2012; Liden, Wayne, Jaworski & Bennett, 2004; North, Linley & Hargreaves, 2000; Pieterse & Thompson, 2010). While that is the case, studies reporting on social loafing with respect to how students organize themselves in executing their group work and the measures they take to address the social loafing phenomenon from Tanzanian scholarly space are so far unknown. This article, therefore, reports on the study that was conducted to addresses this knowledge gap.

Theoretical Framework, Literature Review and the Current Study

In broader sense, 'groups are collections of people who perceive themselves as forming a coherent unit to some degree' (Baron & Branscombe, 2012, p. 394). Like living organisms, social groups develop and finally die. According to Tuckman's Model of 1965 and its revised version of 1977; although from a Therapist perspective, group development involves five stages (Bonebright, 2009, pp. 113-114): *forming* ('the group becomes oriented to the task, creates ground rules and tests the boundaries for interpersonal and task behaviours'); *storming* ('a time of intergroup conflict'); *norming* ('the group develops cohesion'); *performing* ('the group members adapt and play roles that will enhance the task activities'); and *adjourning* ('involves terminating task behaviors and disengaging from relationships').

In the context of the present study, some of these stages have relevant implications on how student teachers go about doing their group assignments. For instance, they need to understand the specific needs of the tasks, solving any potential conflicts that might arise in the due course, performing the tasks in the manner considered appropriate by the group members, and finally submit the completed task to respective instructors for

marking and grading purposes (Kozlowski & Bell, 2003). Social loafing behavior among the group members may manifest in some of these stages as student teachers work on their group assignments, which then reflects particular group processes in relation to member reactions to the social loafers. This is the general aim of the present article.

When working in groups, especially in organizational settings, people constantly are involved in exchange relationships (Cropanzano & Mitchell, 2005). Based on the Social Exchange Theory (SET), such exchanges need to be supported by certain rules and norms for effective accomplishment of different tasks among the parties involved (ibid.). The exchanges include reciprocity and negotiated rules; as well as *rationality* ('the use of logic to ascertain likely consequences and how one should achieve those things that are valued'), *altruism* ('benefiting others even at an absolute cost to ourselves'); *group gain* ('putting the benefits into a single common pot'), status consistency ('the allocation of benefits based on one's station within a social group'), and *competition* ('harming others even when it risks one's own earnings') (Cropanzano & Mitchell, 2005, p. 879). These rules and norms, literally understood as inherently being part of the group processes, are likely to operate within the groups of student teachers when performing different assignments as part of their continuous assessment in higher education. The interest of this article is based on understanding this puzzle in order to have a fuller view of how student teachers execute their group assignments at a Tanzanian tertiary education institution.

In higher education contexts, student groups are formed in order to facilitate the teaching and learning processes. In this context, depending on different circumstances, the groups can be formed by instructors or by students themselves. Importantly, however, proper formation of small groups may result in decreased social loafing tendencies (Synnott, 2016). In either case, the goal is to ensure that students participate accordingly in the assigned tasks; lack of which puts the intended process of learning and its subsequent outcomes in jeopardy. Indeed, literature is inconclusive about which method of group formation is better than the other. For instance, the use of instructor-formed groups have been reported to be less effective due to such factors as social loafing (Pieterse & Thompson, 2010), hence compromising the quality of the learning process when students work in

groups. On the contrary, in recent study, Mbalamula (2018) reported randomized assignment of students to groups as being effective in enhancing student performance on their coursework scores, suggesting instructor-formed groups being better than student-formed ones similar to what was observed by Synnott (2016).

Various factors have been found to determine students' attitudes towards group work and their actual participation. The factors evolve around those related to student characteristics (Revere, Elden & Bartsch, 2008), as well as those relating to the nature of the tasks in terms of their complexity and student workloads (Gupta, Li & Sharda 2013; Kyndt, Dochy, Struyven & Cascallar, 2011; Pfaff & Huddleston, 2003; Struyven, Dochy, Janssens & Gielen, 2006). Further empirical evidence shows that group cohesiveness is essential for group work effectiveness (Alfares, 2017; Bravo, Catalán & Pina, 2018; Piezon & Donaldson, 2005), hence reduced likelihood for social loafing to occur. Similarly, Wolff, Druskat, Koman and Messer (2006) illustrate a clear link between group's emotional competence and its effectiveness as viewed from the ways group members deal with those who do not observe group norms. Indeed, previous research studies, most of which are based in different socio-cultural contexts from those of the present study, have examined on the factors associated with social loafing (Njie, Asimiran & Basri, 2013; Li & Campbell, 2008; Liden, Wayne, Jaworski & Bennett, 2004; North, Linley & Hargreaves, 2000), as well as possible ways to reduce the behavior (Aggarwal & O'Brien, 2008; Sharp, 2006; Kuisma, 2007; Pieterse & Thompson, 2010; Piezon & Donaldson, 2005; Swaray, 2012).

Other evidence indicates that students' participation in group work may be increased when students have reasonable experience of group work (Maiden & Perry, 2011), hence reduced tendencies of social loafing. Similarly, it is claimed that member involvement in activities related to the group work is essential for the success of the group (Alfares, 2017; LaBeouf, Griffith & Roberts, 2016). It is shown that group cohesion and ability of group members to overcome potential conflicts arising within the group, while emphasizing the importance of instructors' guidance to students while performing their group work (Persons & Calabro, 2013) are important factors in group work undertaking. Additionally, member

familiarity before forming groups and embarking on doing group work is essential for group effectiveness (Decuyper, Dochy & van den Bossche, 2010; Mathieu, Maynard, Rapp & Gilson, 2008).

As social actors within the groups, the students are most likely to take different initiatives in attempting to accomplish their group assignments with a view to getting better scores. With social loafing interfering with this common intent for most students in their schooling, the use of different mechanisms to deal with such behavior within their groups is deemed crucial and necessary. This can be achieved through member confrontation to the social loafers (Zastrow, 2009), and reporting to instructors (Boren & Morales, 2018; Goo, 2011). Boren and Morales (2018) observed that member reactions to social loafers were determined by their status, with low status social loafers strictly being treated as per the rules established without further negotiations as opposed to high status social loafers.

A closer analysis of the reviewed literature on group-based assessment and social loafing suggests that empirical studies documenting the processes undertaken by student teachers in accomplishing their group-based assignments in higher education is sparse. In particular, the literature in this field is silent about how students initiate the process of doing their group assignments, how they accomplish it, and how non-loafing group members react to social loafers when working in groups from undergraduate student teachers at a Tanzanian tertiary institution. Specifically, the study addresses the following two research questions:

1. How do student teachers initiate, and go about doing their group assignments at the College?

2. How do group members react to social loafers when doing group assignments at the College, and how effective are these reactions?

Research Methodology

Design and Approach

This study was informed by qualitative approach. The approach was chosen because the study aimed to unveil the participants' subjective views of the issue under investigation (Cohen, Manion & Morrison, 2007).

Consequently, a case study design was used for its ability to provide sufficient and appropriate detail of the phenomenon to allow other practitioners working in similar contexts to benefit from this information (Bassey, 1981). In this case, a single case study design was used (Baxter & Jack, 2008; Yin, 2003). It was, therefore, possible to provide both participants' and researchers' perspectives during the interpretation and discussion of the findings (Ary, Jacobs & Sorensen, 2010). As Zainal (2007) notes, this enabled to get a clearer understanding of the processes involved by the students in carrying out their group assignments.

Participants and Study Site

The participants for the study were 18 Second and Third Year undergraduates who had been group leaders in different group-based assignments in one or more courses at Mkwawa University College of Education in Tanzania. Of these participants, five were female and 13 were male. In terms of their years of study, three were Second Years while 15 were the finalists, Third Year students. These participants were believed to provide enunciated and practical experiences on how they undertook their group assignments and their reactions to the social loafers than the First Year students could do. Purposive and convenient sampling techniques were used to select the participants in which volunteer samples were used (Teddlie & Yu, 2007) as was determined by overarching schedules of the potential participants. In addition, convenient sampling was used to select the study site. It was convenient to conduct the present study at this site because all the authors were working as members of teaching staff at this institution by the time the research was conducted. The permit to conduct the research was granted by the University after which the researchers invited the students to participate in the study during regular lecture sessions. Additionally, some course instructors who had provided group-based work for the students were consulted in order to access students who had been leaders in the groups they once worked in. Thereafter, the potential participants were identified and verbally invited to participate in the study. Then, appointments with the participants for interviews were made.

Data Collection Instrument

Face-to-face semi-structured in-depth personal interviews with the students were used to collect data. The interview questions were first developed by the first author of this article, and then shared among the four authors in order to improve its questions. For consistency purposes, it was agreed that each of the authors to read the introductory paragraph of the interview guide containing information about the purpose of the study and participants' consent and assurance of anonymity of their views to the interviewees. In addition, the participants were informed of the voluntary nature of the study and that they had full freedom to withdraw consent at any point during the interview process. Having developed the final version of the interview questions, a colleague with good expertise in qualitative research was consulted and agreed to go over the interview questions prior to data collection. The inputs helped to improve the quality of the instrument.

The data were collected in the period between May 2018 and September 2018. The data were audio-recorded using voice recorders and note books. The duration for the interviews ranged from 15 to 45 minutes. There was no time limit for conducting the interviews in order to allow for collecting as much information as the participants were able to provide. In total, 18 interviews were conducted of which each author interviewed a minimum of four interviews. With this number, it was observed by all the authors that no new ideas could continue to emerge, signifying a saturation point (Sohn, Thomas, Greenberg & Pollio, 2017). The interviews were conducted in convenient staff offices including the authors' ones for their successful accomplishment. The interview questions focused on how participants initiated and went about doing their group assignments, their reactions to social loafers and effectiveness of these reactions.

Data Analysis Procedures

The data reported in this article were analyzed using both deductive and inductive approaches while observing Braun and Clarke's (2006) six phases

of thematic data analysis which, in the order of the *first* to the *last*, are familiarizing with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report. Our analysis, thus, began with noting down the initial ideas relevant to our research questions during the entire process of data collection (*phase 1*). Then, after data gathering each author transcribed the data individually followed by a repeated listening to the audio-recorded data and reading and rereading the transcripts to ensure that all important information was adequately captured. Transcription of the interviews was done by writing the audio data on a computer followed by repeated review of the transcripts in order to identify recurring responses which helped to generate initial codes of the data (*phase 1 & 2*). We then harmonized the coded data into potential themes based on their relationships, in a repeated review fashion (*phase 3 & 4*), in order to define and name each theme (*phase 5*). In line with the research questions, this then led us to have three main section headings and/or thematic lines as presented in the section that follows. These are procedures involved in doing group assignments (with three sub-themes), member reactions to social loafers (with three sub-themes), and effectiveness of the member reactions. Accordingly, the development of the three section headings was achieved through the use of a more deductive approach reflecting the research questions, whereas the sub-themes were developed inductively (Braun & Clarke, 2006). In this way, a more interpretative approach was used. For the purposes of communicating the findings, the most relevant transcripts were selected to support our lines of argument and inform the relevant research community, practitioners and other stakeholders on the problem under investigation including the use of this particular article (*phase 6*). It should be noted, however, that in analyzing the data the phases were accomplished in an overlapping fashion.

Presentation and Interpretation of the Findings

Procedures Involved in Doing Group Assignments

The intent of the present study was to understand how student teachers go about doing their group work with a view to suggesting appropriate ways of

improving group assignments as part of continuous assessment of students in higher education. From the analysis of students' responses, the following themes came out reflecting the processes undertaken by student teachers in carrying out their group work.

Member identification and familiarity. During the interviews, it was revealed that member identification and familiarity varied depending on the method used to form the groups and the courses pursued. It was easier for the group members to identify and familiarize themselves in student-formed groups than in instructor-formed ones because they had a tendency of doing several group tasks together, as opposed to teacher-formed groups in which students were selected randomly to form the groups. It was also reported that member identification and familiarity was easily done in the courses with few students because many students knew each other unlike in the courses with many students. The following excerpt by one of the participants exemplifies the experiences:

> In student-formed groups, groups are formed depending on our subjects and interests, but instructors insist on gender balance especially female students because they are fewer compared to male students. In teacher-formed groups, students are assigned to groups randomly based on their names on a course whereby sometimes we are not familiar with each other. [Participant 9]

Another participant intensely explained as follows:

> In most cases the groups were formed by individual students depending on the subjects and interests but in few cases instructors were dictating the process by selecting members who will form groups. [Participant 7]

Relatedly, participants expressed that after being provided with the tasks it was important for members of the group to know one another, especially in instructor-formed groups. The participants explained that instructors usually form the groups and post them on the notice boards for students to view. After the posting, students then find one another by writing their

mobile phone numbers on the posted list of student groups in order to do the assigned group work. Participants' experiences with such situations are evident in the following statements:

> … there is another way whereby you are already been grouped by the teacher; course instructor arranges the names based on the students registered for the course and those forming a certain group write their mobile numbers so as to meet and go for the questions. [Participant 3]

It can be argued that the initiation of doing of group work is likely to be difficult in instructor-formed groups as group members may be unfamiliar. It might be even worse if the majorities in such groups are the social loafers, or those who are less concerned with academic achievement, something that is likely to affect the group performance on particular assignments.

Familiarization with the group assignments, task division and performance. It was observed that when provided with group assignments, the student teachers had to first familiarize with the task during their first meetings. As part of familiarizing with their group assignments, it was learned that the students involved in task division and performance. In the process, they set timelines or schedules for their meetings in order to share and discuss what they had been assigned among themselves. The participants maintained that the number of meetings for the group assignments would be determined by the deadline for submitting the task and its associated level of difficult as exemplified in the following selected statements made by the participants:

> After being provided with the tasks, we as members meet together so as to familiarize ourselves with the tasks given, then every member is given a task to work on. After task distribution among members, another day is suggested for everyone to present what he/she has read from various reliable sources during which we may improve some areas of weakness. [Participant 10]

Similarly, another participant stated as follows:

> In my group we happened to meet for about three to four times before compiling the work. The first time is for getting general understanding where we meet and discuss together the task and the requirements of the assignment. The second time we divide the tasks to each individual member of the group and the third time we meet to bring and discuss the feedback of each member's task and lastly the fourth time we start to compile the work. [Participant 12]

Yet, another participant explicitly stated:

> ….actually according to my experience, the work should be done from the very day you are given the task, with at least three meetings whereby during the first meeting the task is divided among the group members so that everyone can go to search for answers on a specific task given based on the question. Then on the second day you meet whereby everyone is required to present and share with the group members to see whether is relevant to every member or not. Thereafter, you meet again for the third time for corrections and finally submit the task. [Participant 1]

Specifically, regarding what determines the number of meetings for their group tasks, some participants remarked as follows:

> … the number of meetings depends on the nature of the group activity provided. If the task is easier or shorter we meet fewer times compared to when we are provided with a difficult or a long activity, such as project work which usually takes much time compared to other group activities like seminars. [Participant 7]

> We usually meet for about three to four times. It was a practical task that was provided on a weekly basis so we met for three to four times to accomplish a week task. The assignments were provided in each week starting from the fourth week of the Semester, so we had almost ten assignments in a Semester. [Participant 11]

Formation of group norms and rules. In understanding how student teachers performed their group work, it was learned that they formed appropriate norms and rules to guide the performance of their group assignments. In forming such rules they stated explicitly what was expected of each group member in accomplishing the assignments. The rules they formed included aspects of member attendance to group meetings and the quality of contributions to the group work. The following statements from one of the participants are worth quoting regarding these issues:

> After forming the groups we usually meet, we set our timetable, prepare some guidelines on how to go about doing the work. So, we prepare some conditions to guide the participants in order to participate fully in doing the work. [Participant 2]

Member Reactions to Social Loafers

The participants provided different responses regarding what actions they take as a response to the social loafers. Following the analysis and interpretation of the findings, these responses are presented as 'approaches to dealing with the social loafers', which are categorized into three broad thematic lines as follows:

Humanitarian approach. It was observed that the participants reacted to the social loafers by trying to make them part and parcel of the group; they did not want to lose them from the groups and subsequently discontinuation from studies. This involved understanding the problems or factors which made them not participate in carrying out the group work and accordingly accommodate them in the groups. The following statements by the participant illustrate the case:

> Actually, for example on my side for those who don't participate fully or if they don't turn up for discussion…, we weigh the reasons for not participating, or if there could be some problems they face…perhaps one may fail to contribute to the discussion because of the problems, … will include his/her name … only to help them. … Sometimes there are those who social loaf because

> they don't know how to do the work, when this happens those who
> know assist those who don't in order for them develop the ability to
> do the work so that in future could be able to do. [Participant 2]

Additionally, the participants highlighted that they usually advised the social loafers on the importance attached to group assignments and their contribution to the groups as the case of the following statements from the participants: "In that regards it depends. For the group that I am leading maybe we can call him/her and talk to them". [Participant 1]. And: "We ask them to increase the efforts when task is provided". [Participant 9]

Another humanitarian approach involved including the social loafers in the finally submitted work as a means of rescuing them from having negative consequences of not participating in the groups including discontinuation from studies. The following statements from the participants indicate the case:

> At the end you find many students who loaf are forgiven due to
> humanitarian reasons ... We start thinking that if his/her name will
> not appear in the group work he/she might be discontinued from
> the College due to incomplete course work results. [Participant 9]

Punitive approach. In almost all the interviews with the participants, this emerged as the common approach taken by student teachers in reacting to the social loafers when doing their group work at the College. The participants maintained that, as a means of sharing the cost of producing group assignments, they usually impose monetary fines to those who do not participate in doing group assignments as scheduled and in line with their established group norms and rules. The fines include paying for all stationery costs involved in completing the assignments such as typing and printing of the final work. The following statements from some of the participants are worth quoting:

> We ask them to pay money for the whole work which will be
> printed for presentation and submission. Although it is not proper,
> we still ask them to do so. [Participant 9]

> In my group, we had set an agreement that any member who will not show up when we meet for the work or who fails to participate fully in the work will pay for the stationery cot of the work in order for his/her name to be included in the group. (Participant 16)

In relation to the punitive approach, it was learned however, that the social loafers had developed their own ways of reacting to group members following their loafing tendencies. For example, ironically, some were concerned about their nonparticipation in the group assignment and even before being punished by other group members regarding paying the stationery costs, they compensated their nonparticipation with payment for all the costs. The following statements by one of the participants typify the case:

> Most often and this is like an existing custom that to some even if you have not done something to them, they will be the first individuals to punish themselves saying that I will pay for stationery costs for the whole work because I know that I didn't participate in doing the work. So, as a group in most cases we agree that they should pay for the costs because we can't incur double costs of working for the group tasks and pay for stationery costs. But to some we take it easy by including their names when we finally submit the work in order to rescue them from carrying the course that because of their weakness… [Participant 3]

Threatening approach. It was observed that students employed the so-called 'threats' in order to challenge those with loafing tendencies so as to make them participate meaningfully in group work. The threats included reporting to course instructors, excluding them from being participants of the finally submitted work, and insisting that there would be individual presentation of the work before instructors. The following statements are worth quoting regarding these reactions:

> Sometimes we threaten them by saying that we are not going to write their names if they don't contribute anything in the discussion. After threatening them, they take their phones and search materials on the Internet then come up with their ideas even

> though sometimes are not from any reliable sources. [Participant 9]

While the foregoing excerpt indicates lack of preparedness and seriousness of some group members when working in groups, which is a typical incident of social loafing, the following statements by one of the participants show why group members do not prefer reporting to course instructors of the loafing behavior of some group members:

> In most cases we did nothing. But sometimes we reported to the instructor informing him/her of the member participation on the group assignment. In the first case, when ignoring a person who social loaf, this means that the person will not get knowledge of the concept from the task. When reported to the instructor, it is like some marks are to be reduced for these members. But this is very rare as it leads to misunderstandings among group members. [Participant 12]

From the quotations above, it appears that some students do not attend sessions when group assignments are given, or instructors do not have time meeting with all group members when providing group assignments to students, instead only have contact with one of the group members (possibly considered as group leader) and provide some extra information and/or guidelines on what is expected of every group member. This seems to affect some of the students in carrying out their group tasks.

Effectiveness of the Member Reactions to the Social Loafers

Our inquiry on whether the reactions of group members to the social loafers yielded mixed results, indicating both positive and negative changes in behavior of the social loafers towards their participation in group work. Overall, a few participants who used to report the loafing tendencies for some of the group members expressed that the approach was effective in some ways. The following statements from the participants illustrate these issues:

> The measures were somehow effective because some students changed their behaviors and started to participate in the group work especially when they were reported to the instructors. [Participant 9]

The participant continued stating further that:

> Some students did not change, for example when you ask them to pay money for stationery costs of the group work they pay because they have money, and continue loafing because they know that they will pay money. [Participant 9]

Yet, another participant elaborated as follows:

> To a larger extent the effective measure is reporting to the instructors because many students fear of being reported to the instructors. [Participant 7]

Similarly, in our probes on the effectiveness of the employed reactions to the social loafers, another participant underscored that:

> To some extent they [measures/reactions] were effective because some students changed, although there are some challenges whereby some students opt to pay money which will be used in typing and printing rather than participating in the group work without considering its effects academically. [Participant 10]

It can be learned, therefore, that the participants were rather concerned about the payment of stationery costs for group work, indicating the possibility of developing more negative consequences to both the loafing and non-loafing group members, as viewed from exchange relationships. The consequences include the development of conflicts among group members as exemplified by the following statements made by the participants:

> Sometimes this mechanism [the punitive approach] worked very effectively but as time went by, we realized that it brought enmity among the group members so we had to stop it. [Participant 11]

From the participants' responses regarding the effectiveness of the reactions indicates a number of factors that determined their effectiveness. The determinants include the intensity of the punishment given, as well as the non-loafing group members' awareness of and avoidance of conflicts with the social loafers. It was also observed that gender-related factors in the group composition accounted for the effectiveness of member reactions to the social loafers. This was especially true when the loafers were female students in groups led by male counterparts. To avoid falling into the trap of sexual harassment, some students tended to leave the social loafers unchallenged, hence continued incidents of social loafing. This is typified by the following participant:

> ...as you know due to the nature of our College whereby most of the group leaders are males, some girls take the advantage of loafing by explaining the excuses to group leaders, and group leaders afraid of asking them many questions because it could be interpreted as sexual harassment… [Participant 9]

From the expressions regarding effectiveness of the reactions to social loafers above, one learns that if you have enough money you can be exempted from full participation in group work provided that you manipulate other members about non-attendance or participation, and that will pay for stationery cost for the group assignments, in return. Generally, it can be said that the reactions used by students to address the problem of social loafing have not been effective enough to curb it despite some of the observed positive outcomes. In view of that, more appropriate intervention measures could be employed to complement with students' initiatives against social loafing at this institution.

Discussion

Procedures Involved in Doing Group Assignments

Understanding group work processes in educational assessment encompasses a consideration of several issues for successful

accomplishment of group assignments by student teachers. The consideration begins with group formation and member identification in relation to the ways through which the groups are formed. Ideally, two ways of forming groups for assessment of student progress are worth noting: instructor-formed and student self-formed methods. In relation to these methods, the instructor-formed groups were reported to be more challenging in initiating and organizing the group assignment tasks and being more susceptible to the occurrence of social loafing as compared to student-formed groups similar to what was observed in some of the previous studies (Opdecam & Everaert, 2018; Pieterse & Thompson, 2010). Based on the findings of the present study, it follows that the occurrence of social loafing hindered proper organization and performance of the group activities among students. One of the notable challenges of instructor-formed groups had been associated with the 'diffusion of responsibility' phenomenon, as the case of helping in emergency situations (Baron & Branscombe, 2012). Student teachers' behavior of initiating their group tasks within instructor-formed groups is comparable to this phenomenon since group members could simply remain silent even when the groups for specific assignment(s) had been displayed by the course instructors while expecting someone else to initiate doing of the task. Consequently, much time for completing the group assignments is wasted something that compromises the quality of task performance. The findings highlight on the importance of proper formation of groups for students to accomplish their group assignment as part of their continuous assessment within the context of higher education. Furthermore, commitment among group members is required regardless of the method used to form the groups as this will help them save time and prepare a quality work.

In providing group assignments, it is important to note that not all tasks are suitable for group work (Curşeu & Pluut, 2013). In fact, group work as part of educational assessment needs to be involving on the part of students, and not simply making them recall the learned information and facts relevant to certain subjects or courses, nor should they be of extreme complexity. The findings of the study have shown that, there were variations in the nature of group assignments across the courses as implicated in the number of times the students met for the work, time spent

for completing them and their submission deadlines. In this context, proper planning for provision of group assignments to students on the part of instructors is important in order to realize the benefits inherent in the philosophy behind the use of group work in higher education. In this regard, course instructors are required to provide more relevant group work to students in order to engage them in collaborative learning groups (Curşeu & Pluut 2013), while at the same time balancing the weight of the task and the available time to complete it. A lack of consideration of these factors in relation to task complexity and student workloads as previous studies (Gupta, Li, & Sharda 2013; Kyndt et al., 2011; Pfaff & Huddleston, 2003; Struyven et al., 2006) suggest affects negatively their perceptions about group assignments which may consequently contribute to social loafing behavior. Attendance to such factors when planning for group assignments makes students develop interests in group work which may then reduce potential challenges associated with the use of group work. Thus, instructors need to prepare group tasks that call for collaborative and cooperative skills from the students to allow for sharing and constructing ideas and information among themselves; course instructors are required to help the student teachers develop appropriate team work skills to this end (Daly, Hoy, Hughes, Islam & Mak, 2015). Preparing such tasks may seem challenging; however, if course instructors possess the required skills in developing the tasks, the use of group work assignments may be a contributing factor to the development of team work and interpersonal skills and values that the 21st Century teachers need to possess.

Reactions to social loafers

Social loafing is worth viewing a threat to academic achievement of students especially when they are assessed on group work basis. To get rid of such threat, group members are likely to employ different means of minimizing the negative impacts associated with social loafing by reacting in different ways to the social loafers. The findings of this study have indicated three major approaches to dealing with the social loafers that the student teachers used; namely, humanitarian, punitive and threatening. Despite the deployment of these approaches, there was still recurring

incidents of social loafing when student teachers worked in groups. It was noted that the high use of humanitarian approach had contributed to the persistent cases of social loafing among student teachers at this institution. In other words, on the one hand, the students themselves are to blame for nurturing the behavior especially when they simply include the social loafers on submitting their group assignments to respective course instructors for marking. They did this in order to rescue their social loafing counterparts from being discontinued from studies, while at the same time experience negative consequences similar to what was pointed out by Cropanzano and Mitchell (2005) about altruism as one of the exchange relationships in group work situations. On the other hand, their failure to take more stiff measures against the social loafers may be due to lack of empowerment among the student teachers to deal with the social loafers; thus, empowering them could help deal with their loafing colleagues more confidently (Barfield, 2003).

The use of punitive approach has also been found to be less effective in dealing with the social loafers. It has been found that the commonly used punitive approach (paying for stationery costs) had often been a lighter punishment when the typing and printing costs are lower rendering its ineffectiveness. Consequently, some of the social loafers were even being motivated to loaf expecting to incur relatively lower stationery costs for their group work, the behavior that could be referred to as 'self-punishing' or 'defensive mechanism' following their loafing; this is a kind of self-presentation (Baron & Branscombe, 2012). This is not only an inequitable exchange but also a threat to delivery of quality education and its ultimate goal of producing quality teachers. This kind of unfairness is even multiplied when there is no proper mechanisms of awarding marks on the basis of individual contribution to group work as previously reported (Hall & Buzwell, 2012; Hassanien, 2006; Refeque, Balakrishnan, Inan & Harji, 2018). This, indeed, needs to be rethought if the value of using group work has to be attained in higher education, particularly when preparing teachers for the 21st Century teaching and learning (Geisinger, 2016; Kereluik, Mishra, Fahnoe & Terry, 2013; Mishra & Mehta, 2017). Developing such skills in teachers is crucial because of their pivotal teaching roles; as (Gordon et al., 2009) postulate, teachers are expected to possess and enable

learners acquire the skills. This makes it necessary for universities preparing teachers to promote the acquisition of these skills by student teachers and, for that reason, there is no doubt that properly planned group assignments for students, in which the problem of social loafing is taken care of, can help develop some of the important skills needed by teachers.

The use of threats in response to social loafers was highlighted by the research participants. Similar to Zastrow's (2009) notions of confrontation, in using threatening approach, it is important to note potential drawbacks of using threats in reacting to other group members as these may negatively affect the lives of the groups and individual members. That is why the promotion of emotional competence within groups is essential in enhancing group effectiveness (Wolff et al., 2006), hence reduced likelihood of social loafing behavior. It was also observed that some group members reported to course instructors of the social loafers. The finding provides support to its use as a means of conflict resolution (Wilmot & Hocker, 2011). This implies that instructors need to work closely with students in order to help them conduct their group assignments accordingly. Indeed, social loafing resembles to a group disease which can have far reaching consequences to individual members and the delivery of higher education in general (Latane, Williams & Harkins, 1979), hence needs to be treated at this particular institution.

Conclusion and Recommendations

The need to focus on the process in addition to the outcome part of group-based assessment is essential in understanding student performance on the tasks in the context of existing social loafing tendencies. Responding to this need, this article is set out to understand how student teachers are involved in group assignments and their reactions to social loafers. The article has indicated that, when working on group assignments, students involved themselves in different processes reflective both positive and negative experiences, including those related to decision making about their tasks and the social loafers. They begin with getting to know one another and then formulate their own norms and rules including scheduling for their meetings. There is no doubt that all this is possible because of the

employment of leadership and decision making skills among the group members. Therefore, training the students on the skills may facilitate their working in groups (Boren & Morales, 2018). The article has revealed three main approaches used by students to react to the social loafers each of which with their inherent drawbacks. In order for the group assignments to be effective, the perceived weaknesses of the used approaches should be addressed for bringing about fruitful results to both students and instructors.

The findings of this study contribute to the understanding of group-based assessment and social loafing in higher education by emphasizing on the importance of proper planning for group assignments, member familiarity, and group norms and leadership skills in successful accomplishment of student group assignments. In addition, knowledge of how non-loafing students react to social loafers is an important contribution the paper makes to existing body of knowledge on the subject, pinpointing on the need to consider the relevance of group assignments in relation to students' workload and their commitment to group work. Indeed, when providing students with group assignment a consideration needs to be made that the students study several other courses which all contribute to their excessive workloads which, then, may affect their participation in different group assignments realized through their loafing tendencies. This observation, however, does not disregard the importance of student commitment to their academic tasks. It only emphasizes that instructors on their part can be the source of the problem in relation to the way they form student groups, the nature of group tasks they provide to students, the deadline they set and, although often overlooked, the kind of support they provide to students in the process of completing the group tasks. When these are attended, the value of using group-based assignments can be experienced by both the students and course instructors.

Based on the findings of this study; first, it is recommended that the instructors should be aware of their role in providing group-based assignments to students such as helping them to form appropriate groups, providing relevant work, supervising the work and instilling leadership skills to the students. Second, students should be trained on the importance of group work and, how to work and manage conflicts arising thereof. Third, as limitations are inherent in almost all studies including the present

study, thus its limitations are worth acknowledging. The findings of this research, which focused on a small sample of second and third-final year undergraduates, may not be generalized to the greater population of students at this institution and that of Tanzanian universities. Future researches, therefore, should adopt larger-scale empirical approaches to address a similar problem. Importantly, it would also be useful to investigate the experiences of potential social loafers of working on group assignments, as the voices represented in this article are of those students who did not identify themselves as social loafers.

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Interdisciplinary Approach-Based Energy Education

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Interdisciplinary Approach-Based Energy Education

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Abstract

The purpose of the current study is to investigate the effect of interdisciplinary approach-based energy instruction on pre-service science teachers' academic achievement and conceptual understanding regarding the concept of energy. To this end, the current study was designed as a quasi-experimental study in line with the pretest-posttest control group design. The activities related to the concept of energy were conducted by using the interdisciplinary approach and the same activities were conducted by using the methods and techniques based on the existing approaches. A total of 66 pre-service science teachers participated in the study lasting for 10 weeks. In the analysis of the data, ANOVA/Post Hoc Test was used. As a result of the study, it was found that the use of the interdisciplinary instructional approach in teaching the concept of energy increased the pre-service teachers' academic achievement and conceptual understanding more than the traditional approaches. Thus, it can be suggested that during the instruction of the energy concept, the features of this concept should be taught in a certain developmental order and the interdisciplinary approach should be used in the activities conducted to teach this concept.

Keywords: energy instruction, energy concept, interdisciplinary teaching, conceptual understanding

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Enfoque Interdisciplinario de Educación en Energía

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Resumen

El objetivo de este estudio es examinar el efecto de la educación energética basada en el enfoque de la enseñanza interdisciplinaria sobre el logro académico y la comprensión conceptual de los candidatos a docentes de ciencias sobre el concepto de energía. Para este propósito, la investigación se diseñó como un estudio cuasi-experimental de acuerdo con el modelo de prueba previa - prueba final. Un grupo experimental y un grupo control se utilizaron en el estudio. Las actividades relacionadas con el concepto de energía son enseñadas por la enseñanza interdisciplinaria en el grupo experimental y las mismas actividades en el grupo de control por los métodos y técnicas basadas en los enfoques existentes. 66 posibles maestros participaron en el estudio y el proceso de investigación duró 10 semanas. En el estudio, se utilizaron "Prueba de Logro de Conceptos de Energía" y "Prueba de la Identificación de Conceptos de Energía de Dos Etapas" como herramientas de recolección de datos y se aplicaron a los participantes como prueba previa y final. Se utilizó la técnica de análisis de varianza de una vía (ANOVA / Post Hoc Test) para analizar los datos. Como resultado del estudio, se ha encontrado que el uso del enfoque de enseñanza interdisciplinaria en la enseñanza del concepto de energía aumenta los niveles de éxito académico y la comprensión conceptual de los candidatos a docentes hacia este concepto. A este respecto, se recomienda utilizar el enfoque de la enseñanza interdisciplinaria en la aplicación del concepto de energía en un cierto orden de desarrollo y la aplicación de este concepto.

Palabras clave: educación en energía, concepto de energía, enseñanza interdisciplinaria, comprensión conceptual

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T he system in which different disciplines come together and we try to make sense of the life by exploring the environment and natural phenomena we encounter can be defined as science. In other words, science is an attempt to define and explain the physical and biological world (Ministry of National Education [MEB], 2017). Therefore, what is aimed in science education is to train science literate individuals who can manage the process of converting their theoretical knowledge and skills into practice and product by integrating science and other disciplines. Science literate individuals are those who research, question, decide through reasoning, think innovatively, have self-confidence, are open to cooperation, express themselves, are enterprising and go on learning throughout their lives with the consciousness of sustainable development. Moreover, these individuals have knowledge, skills, positive attitudes about natural sciences, moral and national values, the understanding of the relationship of natural sciences with engineering, technology, society and environment and psychomotor skills (MEB, 2017). Scientific meanings and science concepts have an important place in training students as science literate, students' converting the basic concepts and principles of science into a natural part of their lives and gaining daily life experiences (Bennett, Lubben & Hogarth, 2007). Therefore, it is of great importance to teach science concepts accurately and precisely throughout the education lives of individuals because these concepts lay the ground for learning other related concepts (Dykstra, 1986). Particularly the correct understanding of the energy concept, which is a core and unifying concept of science, is an important stage in the development of science literacy (Jin & Anderson, 2012; Liu & Tang, 2004).

Energy Concept

Energy is an abstract concept; it is not directly observable and it is not possible to measure the energy directly. In addition, it is not easy to make the definition of the concept of energy because the concept of energy is defined differently in each discipline (Lancor, 2014a). However, when related to science, the concept of energy is seen to be a core and unifying concept in all the disciplines of science and across all the levels of

schooling (Park & Liu, 2016). In this connection, it is of great importance to develop correct and adequate conceptual understanding in students because acquisition of adequate and correct conceptual knowledge allows the interconnection of basic science concepts from different disciplines (Schaal, Bogner, & Girwidz, 2010). For example, for the explanation of many phenomena in science subjects such as work, power, force, movement, photosynthesis, respiration, chemical reactions, chemical bonds, heat and temperature, the energy concept is used (Ellse, 1988; Watts, 1983). The concept of energy makes it possible to interconnect and easily understand these subjects. Moreover, the concept of energy is confronted with in the daily life and we make use of this concept to explain and interpret many occurrences (Taber, 1989). In particular, the production and use of fossil-based energy causes many adverse effects on human and environmental health, causing air pollution, acid rain, global warming and climate changes (Panwar, Kaushik & Kothari, 2011; Worrell, Bernstein, Roy, Price & Harnisch, 2009). The concept of energy is an important concept in terms of understanding and explaining such environmental phenomena (Boylan, 2008; Rizaki & Kokkotas, 2013). This concept also allows the interpretation of some socio-scientific issues such as energy sources, use and distribution of energy, evaluations of the country's energy policies and explaining the role of energy in healthy nutrition (Hinrichs & Kleinbach, 2002). In this regard, it is important to promote students' cognitive development about the concept of energy, which is a central concept in science education and energy education because developing students' conceptual understanding of the concept of energy facilitates finding solutions to the problems encountered in daily life related to this concept and makes it possible to adapt these solutions to different situations (Liu & McKeough, 2005; Lee & Liu, 2010). In this regard, teaching the concept of energy in such a way that it can be learned, understood and constructed in the mind by students from every level of schooling is of great importance.

Teaching of Energy Concept

Within science teaching curriculums and applications, the concept of energy should be included and activities should be conducted to make the features of this concept clear and comprehensible (Liu & McKeough, 2005). The concept of energy has some features such as form, source, transfer, and conversion. These features make the holistic understanding of the concept possible and indicate that energy is a multi-dimensional concept. In this connection, to develop a holistic and multi-dimensional understanding of the concept of energy, these features should be taught by addressing them separately (Domenech & et al., 2007; Liu & Mckeough, 2005; Liu & Tang, 2004; Neumann, Viering, Boone & Fischer, 2013). However, these futures should be placed in curriculums according to a certain developmental order and while designing activities to teach these features, this order should be taken into consideration because in the understanding of this concept by students and their construction of it in their minds, the development of the cognition plays an important role. In this respect, the first thing to be known by students in relation to the concept of energy should be the types of energy and they should recognize the sources of these types of energy. Then, they should learn how energy forms are transformed from one place to another within a system and converted from one form to another (Hermann-Abell & DeBoer, 2011; Liu & McKeough, 2005; Liu & Ruiz, 2008; Neumann et al., 2013; Töman & Odabaşı-Çimer, 2013). In short, in teaching of the concept of energy, the features of this concept should be addressed separately and the instructional activities should be conducted according to a certain developmental order.

Literature Review about Understanding of Energy Concept

When the literature is examined in terms of the understanding of the concept of energy by students from all levels of schooling, it is seen that a great difficulty is experienced in the construction of this concept (Amettler & Pinto, 2002; Kaper & Goedhart, 2002; Köse, Ayas & Taş, 2003; Köse & Uşak, 2006; Stylianidou, Ormerod & Ogborn, 2002). The research conducted in the last twenty years supports this view.

In studies particularly focusing on the concept of energy, it is seen that elementary and secondary school students (Boylan, 2008; Hermann-Abell and DeBoer, 2011; Lay, Khoo, Treagust & Chandrasegaran, 2013; Lee & Liu, 2010; Liu & Tang, 2004; Neumann, Viering, Boone & Fischer; 2013; Opitz, Harms, Neumann, Kowalzik & Frank, 2015; Opitz, Neumann, Bernholt & Harms, 2017; Töman & Odabaşı-Çimer, 2013; Yürümezoğlu, Ayaz & Çökelez, 2009), high school students (Güneş & Taştan-Akdağ, 2016; Opitz, Blankenstein & Harms, 2016; Yuenyong, Jones & Yutakom, 2008), university students and pre-service teachers (Benzer, Karadeniz-Bayrak, Dilek-Eren & Gürdal, 2014; Chabalengula, Sanders & Mumba, 2011; Köse, Bağ, Sürücü & Uçak, 2006; Kurt, 2013; Lancor, 2014a; Lee, 2016; Park & Liu, 2016; Sabo, Goodhew & Robertson, 2016) experience difficulties in understanding the subject of energy, constructing this concept in their minds and explaining issues related to the concept of energy. In addition to this, it has been revealed that elementary, secondary and high school teachers have various misconceptions related to the subject of energy and have not adequately internalized the concept of energy (Bezen, Bayrak & Aykutlu, 2016; Kruger, 1990). Thus, it can be argued that energy instruction cannot be given properly and efficiently in elementary, secondary, high schools and teacher training programs.

In this regard, many studies have been conducted to explore how the concept of energy can be understood accurately and thoroughly by students and how they can develop an understanding at the conceptual level (Akpınar & Ergin, 2004; Aydın & Balım, 2005; Diakidoy, Kendeou & Ioannides, 2003; Kurnaz, 2011; Seraphin, Philippoff, Parisky, Degnan & Warren, 2013). These studies have revealed that interdisciplinary instruction based on the cognitive and constructivist approach (Aydın & Balım, 2005), establishment of interdisciplinary integration (Akpınar & Ergin, 2004), the model-based learning approach (Kurnaz, 2011), conceptual change texts (Köse, Ayas & Uşak, 2006), refuting texts, conceptual change texts and exploratory texts (Diakidoy, Kendeou & Ioannides, 2003), inquiry-based instruction (Seraphin et al., 2013), out-of-school scientific activities (Ertaş, Şen & Parmaksızoğlu, 2011), digital game-based learning systems (Yang, Chien & Liu, 2012), the use of simulation in education (Ispal, Ishak, Ispal & Abdullah, 2016) have

enhanced students' achievement and comprehension related to the concept of energy.

In these studies, it is stated that the concept of energy is used in many of the scientific disciplines related to science, is a interdisciplinary concept and should be addressed in its physical, chemical and biological respects (Akpınar & Ergin, 2004; Aydın & Balım, 2005; Gürdal, Şahin & Bayram, 1999; Lancor, 2014b; Opitz, 2016). In this regard, Opitz (2016) emphasizes the importance of the presence of interdisciplinary connections in each science discipline. Moreover, it is argued that in science curriculums, the teaching of this concept starting from the elementary school, particularly in the disciplines of Physics, Chemistry and Biology, should be performed in an integrated manner (Aydın & Balım, 2005; Benzer et al., 2014; Gürdal, Şahin & Bayram, 1999; Köse, Bağ, Sürücü & Uçak, 2006; Lancor, 2014a; Osbaldiston & Schmitz, 2011). In this regard, in the teaching of the concept of energy, the interdisciplinary approach should be used (Chen, Huang & Liu, 2013; Osbaldiston & Schmitz, 2011; Rizaki & Kokkotas, 2013).

The Current Study

The purpose of the current study is to investigate the effect of instructions in which a unity is ensured between the form, source, transfer and conversion features of the concept of energy and interdisciplinary relationships and connections are established in relation to the disciplines of physics, chemistry and biology on the pre-service science teachers' academic achievement and conceptual understanding. Though there is a great deal of research looking at the energy concept-related academic achievement and understanding of students from different levels of schooling, pre-service teachers and teachers (Benzer et al., 2014; Köse, Ayas & Taş, 2003; Köse & Uşak, 2006; Töman & Odabaşı-Çimer, 2013), there are only few studies exploring how this concept can be better understood and constructed in the mind (Akpınar & Ergin, 2004; Aydın & Balım, 2005; Kurnaz, 2011). However, what makes this study original is the implementation of an interdisciplinary instruction that emphasizes the features of the energy concept and attempts to address these features in a certain order. Moreover, applications related to teaching of this concept

should first be integrated into teacher training programs because for pre-service teachers to be able to play an effective role in teaching of this concept, they need to have a good understanding and conceptual construction of the concept of energy.

In this regard, the research questions of the current study are as follows:

(1) What is the effect of the energy-related activities conducted on the basis of the interdisciplinary instructional approach on the pre-service teachers' academic achievement for the concept of energy?

(2) What is the effect of the energy-related activities conducted on the basis of the interdisciplinary instructional approach on the pre-service teachers' conceptual understanding of the concept of energy?

Method

Research Design

The study was conducted as a quasi-experimental study complying with the pretest-posttest control group design in order to investigate the effect of conducting energy-related activities according to the interdisciplinary approach on the pre-service teachers' academic achievement and conceptual understanding in relation to the concept of energy. The quasi-experimental design is the experimental design used the most commonly particularly in educational studies in which it is not possible to keep all the variables under control (Cohen, Manion & Marrison, 2000).

Table 1. Quasi-experimental Design of the Study

Groups	Pretest	Application	Posttest
Experimental	Energy Concepts Achievement Test Two-Tier Energy Concepts Diagnostic Test	Interdisciplinary Instructional Approach	Energy Concepts Achievement Test Two-Tier Energy Concepts Diagnostic Test
Control	Energy Concepts Achievement Test Two-Tier Energy Concepts Diagnostic Test	Traditional Approaches	Energy Concepts Achievement Test Two-Tier Energy Concepts Diagnostic Test

Participants

The sampling of the study is comprised of 66 fourth-year students attending the Department of Science Teaching at the education faculty of a state university in the fall term of 2016-2017 academic year. The reason for the selection of the fourth-year students for the current study is that they have taken the courses including the concept of energy in their first, second and third years. The students in the sampling were randomly assigned to the control and experimental groups. Thus, there are 33 pre-service teachers in the experimental group (7 males and 26 females) and there are 33 students (12 males and 21 females) in the control group.

Materials

In the study, activities related to the concept of energy were carried out. These activities were developed by the researcher and their piloting was performed.

Activities related to the concept of energy. Within the context of the study, various activities were developed related to the concept of energy. In the design and development of these activities, the seven stages proposed by Roberts and Kellough (2000) were used. The operations conducted in each stage are explained below.

a) Determinations of the subjects. In this stage, the content and subjects in connection with the features of the concept of energy that are form, source, transfer and conversion were determined. This content and the subjects cover the topics in which the concept of energy is addressed within the science curriculums of elementary education (3rd and 4th grades) and secondary education (5th, 6th, 7th and 8th grades).

b) Revision. The anticipated learning outcomes that should be targeted in the instruction of the content and subjects having been determined in line with the features of the concept of energy were determined. The opinions of four experts (biology, chemistry, physics and science educator) about the scope of the determined outcomes were sought. In line with these opinions,

it was determined that in relation to which outcomes, the subjects related to the features of the concept of energy would be incorporated into the activities.

c) Development of activities (determination of educational resources). In this stage, various activities were designed in compliance with the certain subjects and learning outcomes determined in relation to the features of the concept of energy. For this purpose, various books, science textbooks, university general physics, general chemistry and general biology books including the subjects determined in the current study were examined and various experiments and activities in the internet environment were investigated. In this way, a total of 24 activities and 4 worksheets were produced. Some of these activities were produced by making some changes on previously developed activities and redesigned in line with the purpose of the current study. The other activities were originally created by the researcher. As a result, the activities designed and which feature of the energy concept and which subject they belong to are given in Table 2.

Table 2. The Content of the Activities related to the Concept of Energy

Activities	Feature	Subjects
1. Bulb that look like four-leaf clover		Light Energy
Worksheet -1.Disintegrating the light into its components		
2. Energy stored in foods		Chemical Bond Energy
Worksheet -2: Let's make out concept map		
3. Exploration with dart and rubber band	Energy Form	Potential Energy
4. Energy of the dart		Kinetic Energy
5. Rutherford's planet atom model		Ionization Energy
6. Energy in chemical reactions		Bond Energy
7. Let's make a circuit without a battery		Electrical Energy
8. Wave the flame		Sound Energy
9. Watch-feel sorry-discover		Nuclear Energy
10. Is it temperature or heat?		Heat Energy
11. Energy generation with solar panels	Energy Source	Solar Energy
12. Energy in power plants		Power Plants
13. Formation of sound		Formation of Sound

Table 2 (Cont.)**.** The Content of the Activities related to the Concept of Energy

Activities	Feature	Subjects
14. Making a simple battery		Chemical Energy Sources
15. Energy in a plant leaf		Energy in Foods
16. From power plants to our house: Electricity		Transfer of Energy Forms
17. Transfer in marbles		Transfer of Energy Forms
18. Which sound is heard?	Energy Transfer	Sound Propagation
19. Let's drop the pin?		Heat Transfer
20. Energy of our body		Energy Transfer in Living Organisms
Worksheet -3. Energy journey		
21. Newton Balance Balls		Physical Energy Conversions
22. Let's convert the energy		Physical Energy Conversions
Worksheet -4. Let's find the converted ones	Energy Conversion	
23. Energy conversions in pictures		Energy Conversion in Living Organisms
24. Electrolyze		Chemical Energy Conversions

*d) **Organization of the activities**.* In the organization of the activities, two stages were followed. In the first stage, it was determined which concepts the activities would involve, how long the activities would last, which tools and equipments would be needed for experiments, which methods and techniques would be used while conducting the activities, how the evaluation would be conducted at the end of the activity and what the stages of the experiments would be. In the second stage, questions such as what was achieved at the end of an activity, how the activity was associated with the subject and how it would be related to the daily life were prepared.

*e) **Organization of the classroom environment**.* The activities developed in relation to the concept of energy were designed as suitable to be conducted in groups in a science lab environment because lab environments have various tools and equipments and allow working in groups. Moreover, science laboratories have every type of tools and equipments to intervene with any emergency that may occur while experiments are being conducted.

f) Conducting the wrap-up activity. For the wrap-up or summarization of each activity, it was planned to conduct whole-class discussion at the end of each activity. In this discussion, students talk about the result of the related activity, its connection with the real life and which concepts have been learned.

g) Performing evaluation. Evaluation of the activities related to energy was performed by analyzing the responses given to the open-ended questions in the activity worksheets. These responses were analyzed by the researcher each week and then with the feedbacks given they were handed out the groups in the following week.

Instruments

In order to collect data in the study, "Energy Concepts Achievement Test" and "Two-Tier Energy Concepts Diagnostic Test" were employed.

Energy Concepts Achievement Test (ECAT). In order to measure the pre-service science teachers' cognitive domain levels related to their knowledge of the energy concepts, ECAT was developed. With this test, it was aimed to determine the pre-service teachers' cognitive levels related to the concept of energy by asking questions at the levels of phenomenal, conceptual, operational and metacognitive knowledge in the knowledge dimension of the Bloom taxonomy and at the levels of recall, comprehension and application at the cognitive process dimension of this taxonomy. To this end, a question pool including multiple-choice questions related to the learning outcomes included in each subject determined in the study in relation to the concept of energy was constructed. In the preparation of these questions, the knowledge dimension and cognitive process dimension of the renewed Bloom taxonomy were taken into account. In the current study, it was particularly intended for the questions in the energy concepts achievement test to be at the phenomenal, conceptual, operational and metacognitive knowledge dimensions and recall, comprehension and application cognitive process dimensions. Thus, a test consisting of 30 multiple-choice questions was developed to be

administered to the third and fourth-year pre-service science teachers. For the content validity of the test, expert opinions were sought. Within the context of item analysis, item difficulty and item discrimination coefficients were analyzed. In the achievement test, the item difficulty level of 7 questions was found to be ranging from 0.00 from 0.34, indicating that they are difficult; 21 questions were found to have medium difficulty with a coefficient ranging from 0.35 to 0.64 and 2 questions were found to be easy with a coefficient ranging from 0.65 to 1.00. Moreover, the discrimination indices of all the questions in the test are over .020. Furthermore, the reliability coefficient of the achievement test consisting of 30 questions was calculated by using Spearman Brown formula and the reliability coefficient was found to be rx=.75. Finally, for the correct response given to each question in ECAT "1" point was assigned and for the wrong or missing response "0" point was assigned.

Two-Tier Energy Concepts Diagnostic Test (TTECDT). In order to measure the pre-service science teachers' cognitive domain levels related to the concept of energy and to determine their conceptual understanding of this concept, TTECDT was developed. With this test, it was aimed to determine the pre-service teachers' conceptual understanding of the energy concept by asking questions at the levels of phenomenal, conceptual, operational and metacognitive knowledge in the knowledge dimension of the Bloom taxonomy and at the levels of recall, comprehension and application at the cognitive process dimension of this taxonomy. In the development of the two-tier diagnostic test, the steps proposed by Karataş, Köse and Coştu (2003) were followed. In this connection, knowledge hypotheses covering the subjects related to the concept of energy and the concept map for the content was developed. Then, the knowledge hypotheses were associated with the concept map developed and expert opinions were sought for the content validity. After that, within the context of this content for the energy concept, misconceptions reported to be held by students about the concept of energy in the literature were determined. By using these misconceptions, the rational part of the diagnosis test was formed. Thus, two-tier diagnostic test consisting of 21 multiple-choice

questions was developed. Finally, the table of specifications of this two-tier test was constructed.

In order to determine the content validity of TTECDT, expert opinions were collected and interviews were conducted with pre-service teachers to check the comprehensibility and clarity of the questions. In addition, the item difficulty and item discrimination coefficients of the test were calculated. Thus, it was found that there are 8 questions with the item difficulty coefficients ranging from 0.00 to 0.34, indicating that they are difficult; 12 questions with the item difficulty coefficients ranging from 0.35 to 0.64, indicating that they moderately difficulty and there is 1 question with the item difficulty coefficient in the range of 0.65 and 1.00, indicating that it is easy. Moreover, the discrimination indices of all the questions in the test are over .20. Moreover, as a result of the analyses, the Cronbach alpha reliability coefficient of the two-tier diagnostic test was found to be .88.

In the two-tier diagnostic test, following each multiple-choice question, the reason for the response of the related question is also asked for with "because". There are six answer alternatives to be selected to explain this reason, five of which are multiple-choice and one of which is an open-ended. In some questions, the correct reason is among the response options and in some others, the respondent is asked to indicate his/her reasons by filling the empty space given as one of the response options. To illustrate this, one example is shown in Table 3. Moreover, the items in TTECDT are scored by assigning "3 points" for the correct response and the correct reason; "2 points" for the false response but correct reason; "1 point" for the correct response but the false reason and "0 point" for the false response and the false reason.

Table 3. A sample question for the two-tier diagnostic test

Question-3. Which of the following is **wrong** for the energies possessed by a basketball along the way it follows towards the basket in a projectile motion**?**
A) While the ball is approaching the basket, the potential energy decreases, kinetic energy increases.
B) The ball has kinetic, potential and heat energy until it reaches the basket.
C) While the ball is at the highest point, its attraction potential energy is also the highest.
D) *While the attraction potential energy of the ball is converting into kinetic energy, its total energy increases.
E) When the ball falls on the ground and stops, it has some certain energy.

Because-3:
A) A stable object does not have energy.
B) *According to the conversion of energy, even if the kinetic and potential energy of an object changes, the mechanic energy that is the total energy does not change.
C) When an object is left falling, all of its attraction potential energy simultaneously changes into kinetic energy.
D) Attraction potential energy is not dependent on the height.
E) Kinetic and hear energies; as in potential energy, change depending on the height and mass of objects.
F) …………………………………………………………………………………………………
…

*Both correct response and correct reason.

Procedure

The current study lasted for ten weeks, two class hours (2x50 minutes) a week. During this ten-week period, activities were conducted within the first eight weeks and the data collection tools were administered within the last two weeks. In the current study, the activities related to the concept of energy were conducted on the basis of the interdisciplinary teaching approach in the experimental group, while they were conducted on the basis of the traditional approaches in the control group. In the experimental group, each activity was conducted by relating it to the disciplines of physics, chemistry and biology in a unifying manner in compliance with the interdisciplinary teaching approach. Moreover, the activities performed in the experimental group were also classified according to the features of the energy concept (energy form, source, transfer and conversion). On the other hand, in the control group, each activity was classified as belonging to one of the disciplines of physics, chemistry and biology and performed within the context of a single discipline as independent from the others by using the traditional methods. These traditional methods were demonstration,

experiment, discussion, sample case and analogy, and the brain-storming technique and group work. These methods and techniques were selected according to the structures of the activities. Thus, in both of the group, activities were carried out by using the same methods and techniques. However, while the activities were carried out in the experimental group in an interdisciplinary manner and following a certain developmental order of the features of the concept of energy, these activities were performed in the control group as required in the existing program separately within the context of the disciplines of physics, chemistry and biology.

Instruction of the experimental and control group. Prior to the applications, the data collection tools were administered to both of the groups as pretest for two weeks. Moreover, the experimental and control group students were informed about the applications in the first week. They were informed about how the activities related to the concept of energy would be conducted, how and when classroom discussions would be conducted and how feedback would be given for activity worksheets. In addition, both in experimental and control groups, groups of five students were formed. The activities were conducted in the experimental and control groups for eight weeks. In the experimental group, the energy forms were studied for three weeks, energy sources for two weeks, energy transfer for two weeks and energy conversion for one week. Yet, in the control group, the energy concept-related activities were done for five weeks in relation to the discipline of physics, for two weeks in relation to the discipline of chemistry and for one week in relation to the biology. Prior to these applications, the researcher had already provided the tools and equipments and activity worksheets for the experimental and control group students. The participants conducted the activities according to the given instructions and the activities were discussed within groups. Moreover, the questions involved in the activities were answered by means of group discussions. Yet, though they conducted group discussions, they answered the questions in their own activity worksheets. At the end of the activities, the pre-service teachers conducted classroom discussions about the related activity. During the classroom discussions, it was addressed what the students hadn't understood and internalized in relation to the activities, every type of

information about the events which had drawn their attention in the experiments was shared; in short, a summary of the activities was made. Furthermore, during the discussions, the activities were connected to each other and related to the daily life. Following the classroom discussions, the researcher collected the activity worksheets of each student to give feedbacks for their responses to the questions in the worksheets. The activity worksheets with the given feedbacks were distributed to the students. In addition, the answer key to the activity worksheet of the previous week was hung on the student board. In this way, the students found the opportunity to compare their answers given in the previous activities and to see the correct answers. Finally, the data collection tools were administered to the students as posttest.

Data analysis. In the analysis of the data, in cases in which there was one dependent variable, one independent variable and one or more covariables, One-way ANCOVA was run to determine whether there is a statistically significant difference between the groups. In this connection, as the independent variable, the groups (experimental and control groups) were taken; as the dependent variable, the posttest scores of the experimental and control group students taken from "Energy Concepts Achievement Test" and "Two-Tier Energy Concepts Diagnostic Test" were taken. As the covariance, pretest scores of the both groups of students taken from these tests were taken. The reason for taking the pretest scores as the covariance is that these pretest scores might have exercised some influence on the posttest scores (Pallant, 2007). Thus, the problem that could emerge when the groups are not equal was eliminated.

Results

Findings Related to the First Research Question of the Study

What is the effect of the energy-related activities conducted on the basis of the interdisciplinary instructional approach on the pre-service teachers' academic achievement for the concept of energy?

Table 4. Descriptive data of the pre-test and post-test scores.

		N	Mean	S.D.	Std. error.
Pre-test	Experimental group	33	13.75	3.22	.56
	Control group	31	13.61	2.97	.53
Post-test	Experimental group	33	19.09	2.69	.46
	Control group	33	17.39	3.38	.58

When Table 4 is examined, it is seen that while the mean score of the pre-service teachers from ECAT prior to the applications was 13.75, it became 19.09 after the applications. In a similar manner, while the mean score of the control group students prior to the applications was 13.61, it became 17.39 after the applications. Therefore, the ECAT pretest and posttest scores of the experimental group and control group students were checked and determined to be the common variable and whether there is a significant difference between the ECAT posttest scores of the groups was tested by using one factor ANCOVA. Moreover, prior to the analysis, normality, linearity, homogeneity of the variance, homogeneity of the regression curves hypotheses were satisfied. In this connection, the results of the ANCOVA analysis are given in Table 5.

Table 5. ANCOVA results for the effects of interdisciplinary teaching approach on the ECAT.

Source	Sum of squares	df	Mean square	F	p	μ^2
Corrected Model	74.250	3	24.750	2.987	.038	.130
Intercept	985.335	1	985.335	118.909	.000	.665
Pre-test	.211	1	.211	.025	.874	.000
Group	40.921	1	40.921	4.938	.030	.076
Error	497.187	60	8.286			
Total	22254.000	64				
Corrected Total	571.438	63				

When Table 5 is examined, it is seen that the pre-service science teachers' ECAT posttest scores differed between two applications [F (1,60) = 4.938, p =.03] and this difference has a moderate effect size (partial eta

squared = .076). This difference is in favor of the experimental group students' ECAT posttest scores. Also using the commonly used guidelines proposed by Cohen (1988) (.01=small effect, .06=moderate effect, .14=large effect), this result suggests a moderate effect size. Thus, it can be argued that the interdisciplinary approach implemented in the control group is more effective in enhancing the pre-service teachers' academic achievement for the concept of energy.

Findings Related to the Second Research Question

What is the effect of the energy-related activities conducted on the basis of the interdisciplinary instructional approach on the pre-service teachers' conceptual understanding of the concept of energy?

Table 6. Descriptive data of the pre-test and post-test scores.

		N	Mean	S.D.	Std. error.
Pre-test	Experimental group	32	21.21	4.44	0.78
	Control group	31	19.93	6.11	1.09
Post-test	Experimental group	29	35.79	7.30	1.35
	Control group	30	29.43	8.72	1.59

When Table 6 is examined, it is seen that while the experimental group students' TTECDT pretest mean score was 21.21, it became 35.79 after the application. In a similar manner, while the control group students' pretest TTECDT mean score was 19.93, it became 29.43. Thus, the experimental and control group students' TTECDT pretest mean scores were checked and determined to be the common variable and whether there is a significant difference between control and experimental groups' TTECDT posttest mean scores was tested by using one factor ANCOVA. Moreover, prior to the analysis, normality, linearity, homogeneity of the variance, homogeneity of the regression curves hypotheses were satisfied. In this connection, the results of the ANCOVA analysis are given in Table 5.

Table 7. ANCOVA results for the effects of interdisciplinary teaching approach on the TTECDT.

Source	Sum of squares	df	Mean square	F	p	μ^2
Corrected Model	1154.237	3	384.746	6.739	.001	.269
Intercept	4089.483	1	4089.483	71.624	.000	.566
Pre-test	19.044	1	19.044	.334	.566	.006
Group	431.308	1	431.308	7.554	.008	.121
Error	3140.305	55	57.096			
Total	66841.000	59				
Corrected Total	4294.542	58				

When Table 7 is examined, it is seen that the pre-service science teachers' TTECDT posttest scores differed between two applications [F (1,55) = 7.554, p =.008] and this difference has a large effect size (partial eta squared = .121). This difference is in favor of the experimental group students. Also using the commonly used guidelines proposed by Cohen (1988) (.01=small effect, .06=moderate effect, .14=large effect), this result suggests a very large effect size. Thus, it can be argued that the interdisciplinary approach implemented in the experimental group is more effective in enhancing the pre-service teachers' conceptual understanding of the concept of energy.

Discussion and Conclusion

In relation to the first research question of the current study, it was concluded that teaching of the activities related to the concept of energy by using the interdisciplinary instructional approach is more effective in enhancing the pre-service science teachers' academic achievement. There might be four different factors leading to the emergence of this result. First of these elements is making the students realize all the features of the concept of energy. That is, the activities related to the concept of energy include the features of the concept such as form, source, transfer and conversion and they can be presented in a unifying manner only by means of the interdisciplinary teaching approach. In this way, the pre-service teachers learn what the forms of energy are and how these forms of energy are obtained and recognize how the forms of energy are transferred and

how it is converted from one form to another. In this way, the pre-service teachers can learn the features of the concept of energy in a unifying manner by relating them to each other without making any discrimination between disciplines. This is claimed to increase the academic achievement in relation to the concept of energy. Similarly, Domenech et al. (2007) and Neumann et al. (2013) emphasize that energy form, source, transfer and conversion should be involved in teaching of the concept of energy; that these features should be addressed holistically and students should be made to realize this; thus, their academic achievement can be enhanced. In this regard, according to Liu & McKeough (2005) multi-directional and holistic approach needs to be adopted in teaching of the concept of energy. Here what is meant by Liu & McKeough (2005) with the multi-directional approach is conducting activities by using an approach including all the aspects of the concept of energy and its features. Similarly, it is stated by Liu and Tang (2004), the concept of energy should be addressed within a curriculum by using a multi-dimensional and holistic approach. The second factor is that in the activities related to the concept of energy, the features of the concept should be taught in a certain developmental order and through an interdisciplinary approach. In the literature, it is stated that in teaching of the concept of energy, first energy forms and sources should be taught, followed by its features such as transfer and conversion (Hermann-Abell & DeBoer, 2011; Liu & McKeough, 2005; Liu & Ruiz, 2008; Neumann et al., 2013) because students first need to know the forms of energy related to the concept of energy and recognize what the sources of these energy forms are. Then, they need to learn how energy forms are transferred from one place to another within a system and how they are converted from one form to another. Thus, the student can learn the concept of energy in a comprehensive and unifying manner. In this respect, the activities developed within the context of the current study first introduce the forms of energy to the students, then make them recognize the sources of energy, after that present experiments related to energy transfer and finally provide the students with opportunities to understand the conversion of energy. The activities are presented to the students by means of interdisciplinary connections. In this way, the students do not have to make discrimination across the disciplines and do not experience the confusion of which energy

form belongs to which discipline. For instance, students experience difficulties in deciding whether the light energy belongs to the discipline of physics or biology. This prevents the holistic understanding of energy. Thus, the interdisciplinary instructional approach, which interconnects the disciplines and addresses the concept of energy in a holistic manner, has come to the fore (Klemow, 2015; Nordine, Krajcik & Fortus, 2010). Moreover, Opitz et al. (2015) emphasize that there should be more interdisciplinary connections between the contents related to the each discipline of science for energy instruction. The related research has revealed that the use of integration and interdisciplinary approach-based activities enhances students' achievement (Akpınar & Ergin, 2004, Aydın & Balım, 2005). The third factor might be the pre-service teachers' questioning the results of the experiments by relating to the concept of energy in the group discussions and during the classroom discussion, their questioning the features of energy in a more extensive and holistic manner. Seraphin et al. (2013) stated that the use of inquiry-based activities in classes focusing on the teaching of energy is effective in improving students and teachers' course achievement. The final factor might be the reification of the concept of energy, which is an abstract concept, by means of activities and worksheets addressing all the dimensions of energy. Similarly, in their works on the concept of energy, Rizaki and Kokkotas (2013) used worksheets and proposed an effective instructional model to be used in energy instruction. In this model, worksheets occupy an important place as they help reify the concept of energy; thus contributing to students' cognitive development.

In relation to the second research question of the current study, it was determined that teaching energy-related activities on the basis of the interdisciplinary instructional approach is more effective in developing the pre-service teachers' conceptual understanding of the concept. There might be three factors leading to this result. The first factor might be that the interdisciplinary instructional approach increased the pre-service teachers' knowledge about the concept of energy because increasing understanding and knowledge of the concept of energy might have positively affected the development of the conceptual understanding. In the literature, it has also been reported that there is a positive correlation between students'

knowledge level and conceptual understanding (Diakidoy, Kendeou & Ioannides, 2003; Ispal et al., 2016; Lee, 2016). In addition, Boylan (2008) argued that lack of knowledge about the concept of energy prevents creating connections between the features of the concept and thus, the thorough understanding and conceptual understanding cannot develop. The second factor can be the discussions conducted by relating the samples concerned with the daily life to all the disciplines because when the interdisciplinary approach is used, the features of energy in all the disciplines are taught in a unifying manner, leading to construction of related concepts. In this connection, discussion of the concept of energy by relating it to the daily life in such a way as to include all the disciplines is of great importance for the development of conceptual understanding. The last factor might be that within the interdisciplinary instructional approach, the concept of energy is introduced in a unifying manner in connection with the other disciplines, resulting in better conceptual understanding because in general students try to explain the occurrences regarding the concept of energy by relating it to a single discipline and create connections with only concepts and phenomena specific to this discipline (Lancor, 2015). This makes the understanding of the concept of energy more difficult. However, adoption of the interdisciplinary approach eliminates this problem and helps students better develop their conceptual understanding.

In light of the findings of the current study, it can be suggested that the interdisciplinary approach be used in the instruction of the concept of energy in teacher training programs. During this instruction, all the features of the concept of energy should be addressed separately and the activities should be planned considering a specific developmental order such as energy form, energy source, energy transfer and energy conversion. Moreover, in order to enhance pre-service teachers' information and conceptual understanding of the concept of energy, the features of the concept should be addressed by means of different experiments and activities and should be related to the daily life.

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Motivational Effects of Technological Resources in Bilingual Education Settings

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Motivational Effects of Technological Resources in Bilingual Education Settings

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Abstract

Neuroscience research shows that motivation is considered to be one of the determining factors for effective learning in any context. In the modern technological era, the motivational effect of the use of technological resources in bilingual settings is an interesting field of research. Considering this assumption, the aim of this study is to analyze whether students are more motivated when learning history and science subjects within the CLIL (Content and Language Integrated Learning) approach if videos are used. This study was conducted on primary school students from third grade to sixth grade. It involved "Ginés de Sepúlveda" and "La Inmaculada" schools in the province of Cordoba in Andalusia, Spain. The sample comprised 85 students. Eclectic research combining a qualitative and a quantitative methodology has been applied in this study. The findings show that the use of videos within the classroom motivates students, by creating a relaxing and comfortable environment in bilingual education settings.

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Efectos Motivacionales de los Recursos Tecnológicos en Contextos de Bilingüismo Educativo

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Resumen

La investigación en neurociencia muestra que la motivación se considera uno de los factores determinantes para el aprendizaje efectivo en cualquier contexto. En la era tecnológica moderna, la motivación como resultado del uso de recursos tecnológicos en entornos bilingües es un interesante campo de investigación. Teniendo en cuenta esta premisa, el objetivo de este estudio es analizar si los estudiantes están más motivados en el aprendizaje de las asignaturas de Historia y Ciencia en el enfoque AICLE (Aprendizaje Integrado de Lenguaje y Contenidos) a través del uso de vídeos. Este estudio se ha realizado en los cursos de tercero a cuarto de educación primaria en la provincia de Córdoba (Andalucía), España. La muestra comprendió 85 estudiantes. Se ha aplicado un enfoque ecléctico que combina una metodología cualitativa y una cuantitativa en este estudio. Los resultados muestran que el uso de vídeos dentro del aula motiva a los estudiantes, proporcionando un ambiente relajante y cómodo en entornos bilingües educativos.

Palabras clave: motivación, recursos tecnológicos, vídeos, AICLE, contexto educativo bilingüe

Motivation could be considered as the most problematic and discussed issues in the current educational framework. According to Dörnyei (1994, p. 273), "motivation is one of the main determinants of second language learning achievements", adding that "the last three decades have seen a considerable amount of research that investigates the nature and the role of motivation in the L2 learning process".

Similarly, many authors have sought alternative methods to traditional teaching techniques to achieve motivation in L2 students, with Dörnyei (2001) being one of the most relevant. Akram and Malik (2012), Shabiralyani et al. (2015), Mathew and Alidmat (2013), Ismaili (2013), Rocillo (2014), Rodríguez (2013) and Arroio (2010), have focused on the use of video or audio-visual aids in different contexts. However, there are very few studies on the use of video in bilingual education context.

The aim of this study is to analyse whether the use of videos may increase motivation and interest in primary school students within the context of the CLIL methodology in the subjects of history and science, if we consider the use of video as a complement to the subject instead of a fundamental pillar.

Content and Language Integrated Learning (CLIL)

The concept of Content and Language Integrated Learning (henceforth, CLIL) was first conceptualized in 1994 in Europe as an attempt to join language and content together through a foreign language (Guillamón & Renau, 2015). According to Coyle, Marsh and Hood (as cited in Guillamón & Renau, 2015), it could be defined as a "dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language". Thus, this educational scheme "offers the students not only the possibility of learning the contents of a specific module […] but also an improvement of language skills with an additional language" (Ioannou-Georgiou & Pavlou, as cited in Guillamón & Renau, 2015).

However, this "additional language" which is used in lessons in order to improve skills is not the learning target in this methodology. On the

contrary, "the language is treated as a functional tool rather than the explicit object of study" (Marsh & Frigols, 2012). Consequently, we may conclude that the CLIL approach is "neither language teaching, nor subject teaching, but rather a fusion of both". As a result, even though language learning is not the purpose of this approach, teachers must know the vehicular language employed in the lessons, so as to implement CLIL programmes successfully. Both Marsh and Frigols (2012) and Guillamón-Suesta and Renau (2015) support this idea. According to Marsh and Frigols (2012) "all teachers consider themselves to be responsible for language development to a greater or lesser extent, even if the language focus is very, very small indeed". Therefore, the burden of vehicular language learning also relies on the teachers of content subjects. Furthermore, Guillamón & Renau mention Pavón and Ellison (2015) to stress the necessity of a change in "teacher training" since "traditional methodologies employed by teachers need to be modified and adapted to the innovative CLIL conditions and competences".

In conclusion, CLIL methods involve a renewal of didactic approaches and a "breaking of boundaries, and changing of the ways in which some subjects are learned as separate disciplines" (Marsh & Frigols, 2012). The CLIL approach is also the result of a combination of four principles known as the 4Cs Framework conceived by Coyle (as cited in Guillamón & Renau, 2015). Thus, a successfully implemented CLIL lesson should combine:

• Content: referring to the auspicious acquisition of knowledge of a content subject.
• Cognition: concerning the mental processes that take place in the integration of both language and concept learning.
• Communication: regarding the use of the vehicular language and its proper establishment in the subject lessons at the hands of the student.
• Culture: considered to be an essential part of the CLIL approach. Students should have knowledge of the culture and history of both languages.

Based on the aforementioned principles, Casal and Moore (2009) and Lasagabaster (2011) identified some specific objectives that must be fulfilled in order to achieve the proper implementation of CLIL methods.

Firstly, Eurydice (cited by Lasagabaster, 2011), classifies the following objectives into four categories (socio-economic, sociocultural, linguistic and educational objectives). The socio-economic objectives refer to preparing pupils for life in a more internationalized society and offering them better job prospects in the labor market. Sociocultural objectives aim to convey values of tolerance and respect vis-a`-vis other cultures to pupils through the use of the CLIL target language. The primary aim of linguistic objectives is to enable pupils to develop language skills which emphasize effective communication, motivating pupils to learn languages by using them for real practical purposes. Finally, educational objectives aim is to enable pupils to develop subject-related knowledge and learning ability, stimulating the assimilation of subject matter by means of a different and innovative approach.

Based on the previous classification of Lasagabaster (2011), Casal and Moore (2009) outline a number of specific objectives. Linguistic and educational objectives refer to the learning of some subject content using a language other than the L1 (First Language). To this end, a range of the most widespread languages in the European Union should be encouraged. More specifically, linguistic objectives aim to ensure that the methodology implemented at both at primary and secondary levels is based on communication, interaction by means of language immersion and the balanced development of oral and written skills. From a linguistic point of view, the goal is the development of general skills while simultaneously embracing the L1 as well as the L2 (Second Language), and in the latter stages a L3 (Third Language). This implies not only an increase in partial linguistic competences in different languages, but also the development of a pan-linguistic consciousness. Furthermore, learners will be confronted with different codes which will lead them to reflect upon linguistic behavior. This approach should foster a special development of learners' metacognitive skills and a natural use of languages rather than an explicit knowledge of linguistic codes. Linguistic, educational and socio-economic objectives are those which aim to enable students to manipulate language in relation to different areas and academic content, multiplying the contexts wherein they will be able to efficiently use languages linked to academic and professional fields. More specifically, educational objectives seek to

enable students to manipulate diverse linguistic codes in order to 'do things', developing cognitive flexibility towards the analysis and observation of learning processes. Finally, sociocultural objectives are those which aim to expose students in bilingual education to other realities from an early age, allowing them to draw comparisons with their own surroundings and increasing their interest in different cultures with different traditions, customs, institutions and techniques. To conclude, with regards the beneficial results of the implementation of the CLIL programme, Coyle (2006) points out that CLIL methods have the potential for "providing opportunities involving problem-solving, risk-taking, confidence building, communication skills, extending vocabulary, self-expression and spontaneous talk". These advantageous outcomes may explain why the CLIL methodology has gained so many supporters in Europe and, in particular, in Spain.

It should be noticed however, that for the purpose of the present paper, only one of Marsh and Frigols' reasons for CLIL implementation (2012) will be highlighted, that of, "Increasing learner motivation and building self-confidence towards learning English". The issue of motivation in CLIL programmers' will be discussed in due course.

The Video and Its Impact on Motivation in CLIL

Two of the subjects which may cause most anxiety or lack of interest in students in CLIL programmes are history and science. Essentially, this is due to the amount of content involved and to the problems they pose in terms of the comprehension of chronological events or scientific theories and formulas in a language which differs from the mother tongue. In relation to the content taught in science, it is necessary to point out that the areas of "biology, mathematics, Earth's science, physics, astronomy and chemistry" (Linares, 2016, p. 24) are included in only one subject. The content of science subjects should be explained carefully in order to increase students' confidence and motivation towards learning, in addition to the use of language frames. Therefore, the use of videos, used as a complement to the explanation of content, may lead to very positive results in students. Additionally, Arroio (2010) states that students usually

demonstrate negative attitudes towards scientific subjects. Moreover, Arroio (2010) adds that films or videos are resources capable of motivating students and encouraging them to engage in critical thinking in a scientific context. According to Bellés-Fortuño, B., Ferrer Maestro, J.J. & Benedito Nuez, J. (2013), history is a challenging subject as students have to learn and understand historical facts, social orders, changes in the past and how the past may interfere with the present. Many authors have pointed out that educational methods are a key pillar when considering an increase in students' motivation. According to Anjomshoa, L., Branch, K., Sadighi, F. & Branch, S. (2015), the manner in which the teacher approaches the teaching strategy will have an effect upon motivation. Therefore, they add that an enthusiastic approach is more likely to motivate than a dull approach.

Likewise, Dörnyei (cited in Coyle, 2006) states that classroom strategies which make learning stimulating and enjoyable (for instance, "presenting tasks in a motivating way and building learners' self-esteem and confidence") are needed to maintain motivation. Similarly, among the most relevant factors involved in motivation, Gardner (2007) highlights the educational context which was connected to the educational methods used in lessons. Several studies have been carried out in order to stress the use of video as an educational method. Ismaili (2013) conducted a study in which the impact of the use of films as an additional resource in both experimental and controlled groups' motivation was analyzed. As a result, she concluded that there are a number of benefits which could arise from the use of films, as opposed to traditional lessons based on reading, such as an improvement in communication skills along with interaction in lessons, among others. According to Ismaili (2013), not only were students more motivated to "see and hear real-life situations than to follow the activities in the graded book" but students' perceptions also changed, they claimed that films provided a more relaxed atmosphere (which, as it was shown in BPNT –Basic Psychological Needs Theory–¬, may enhance motivation, see "relatedness"). Students from the study also concluded that they were more interested in learning English and in following the lesson carefully. Wolpert (2012) supports the idea that the visualization of films or pictures can help to increase interest and learning levels in students and, thus, can raise

motivation levels. When considering other reasons why video could enhance students' motivation, Rodríguez (2013) highlights that it could be connected to students' spare time. Likewise, Rocillo (2014) suggests that students feel comfortable with its use and the possibilities it could create. Another factor to take into account, is that students have to confront real communicative scenarios, and, consequently, they feel more interested and motivated towards the subject.

Finally, according to Gardner's theory of multiple intelligences, motivation is also enhanced through the development of different intelligences presented in students (as cited in Prieto et al., 2002). Similarly, Prieto et al. (2002) state that considering the strengths of students leads to an opportunity to promote significant learning. Additionally, students will be willing to learn new concepts.

The Use of Video in Bilingual Education

Students in the 21rst century interact socially via internet, tools and social networks are used as a natural mean of communication . The students spend more time with audiovisual than with printed resources. Since 1990 YouTube is the most used website. According to (Alwehaibi, 2015), YouTube is an an effective instructional tool for enhancing content learning of EFL college students and should be considered an important teaching resource in classrooms. Another artefact that is gaining consideration as tool for student´s learning is emerging mobile technologies. Ma. (2017, p. 183) states that:

> "…a new socio-cultural framework is constructed to capture the key components involved in mobile technologies-mediated L2 learning and to describe the dynamism and interaction among the components, involving L2 agency, personalization, tools, knowledge, communications and entertainment. In addition, L2 agency plays an important role in determining how learners employ mobile technologies in mediating and personalizing their language learning".

Regarding the use of video specifically, Peña and Condon (2014) identify a range of authors who support its use. Thus, Harmer (as cited in Peña & Condon, 2014, p. 157) points out that these videos must be adapted according to the "level and interest of students". This idea is also supported by Bravo (1996, p. 4), stating that the creation of a "teaching strategy" is required since the video alone does not teach by the mere fact of being visualized by the students (Bravo, 1996, p. 4). Therefore, it is the teacher who ensures that "the students understand and retain the content transmitted by the video" (Bravo, 1996, p. 4). Accordingly, and as mentioned by the British Council (as cited in Peña & Condon, 2014, p. 157), there are a number of factors which must be taken into account when selecting the video to be used. Some of these factors are: "language content", "the amount of repetition of the language content", the connection between the language register used in the video with "the language curriculum or the course book", and, finally, "the language level ".

Additionally, Peña and Condon (2014) recommend several activities that may be carried out alongside the video, in order that students feel involved and recognize the purpose behind its use. Occasionally, if students cannot clearly identify the aim behind the use of the video, it might become boring for them. For this reason, the use of activities related to the video contributes not only to making lessons more dynamic, but also contributes to create a clear goal which must be fulfilled when viewing it. Some such activities mentioned by Peña and Condon (2014) are the following: firstly, playing the video without sound or playing with sound and covering the picture. Secondly, dividing the class in half, and asking one half to face the screen, while the other half sit with their backs to the screen. Thus, one half must describe the scenes to the other half, enhancing cooperative learning. Thirdly, freezing the picture and asking students to guess what will happen next. It would also be useful at this stage to highlight a number of different types of videos. Peña and Condon (2014) identify a number of different types. They include animation films and cartoons, educational programmes, dramas, TV series or soaps. In contrast, Bravo (1996) outlines a completely different classification with reference to Cebrián (1987) and Schmidt (1987). Based on this conceptualization of the educational video, the following types of videos can be identified:

- Curricular videos, those that "are specifically adapted to the teaching plan of the subject".
- Cultural dissemination videos
- Scientific and technical videos
- Videos for education are those which, without an educational purpose, are used as a "teaching resource".
- Instructive videos, "whose mission is to instruct or achieve the knowledge of a content by the students".
- Cognitive videos, "if those videos try to teach different aspects related to the subject learners are studying".
- Motivational videos
- Modeler videos, "which display a number of models to imitate"
- Ludic or expressive videos, "intended for students to learn and understand the language of audio-visual aids".

Santamaría (2014, p. 8) highlights the distinction between a "teaching resource" and "teaching mean". He supports the idea that a "teaching mean" is "any instrument made with the intention of easing the teaching and learning processes (for example, a textbook or a multimedia program)". Therefore, this term refers to those tools that are used in education which have been expressly designed for this purpose. Furthermore, Santamaría (2014, p. 8) points out that a "teaching resource" "is any instrument that, in a particular educational context, is used for the purpose of teaching or for easing the development of activities (for example, a documentary about volcanoes)".

Monge (2013, p. 22), also offers another definition of the concept of "teaching resource" by citing Gimeno (cited by Monge, 2013), which he defines as any instrument or object that may be used as a resource in order to offer opportunities for learning a concept through its manipulation, observation or reading, or to enable teachers to take part in the development of some teaching function with its use. In light of the distinction between "teaching resource" and "teaching mean" identified above, in the present paper we will consider the use of videos as a "teaching resource".

Functions

The functions of the video may be numerous depending on its uses and, also, the environment where it is included. According to Ferrés (cited in Fandos, 1994), the main functions of the video are the informative function, the motivational function, the expressive function, the evaluative function, the research function, the fun function, and finally, the metalinguistic function. Adame (2009) adds some additional functions of videos to this list including the ability of videos to encourage participation, to generate interest in a topic and to encourage a critical spirit in debates related to the audio-visual information presented. He also identified the ability of videos to develop creativity by allowing the student to practice integrating different learning tools and to avoid exclusively rote learning. Furthermore, he considers that videos assist students to better understand themselves and their environment and increase the effectiveness of teacher explanations. Finally, they may help develop skills and attitudes because they require a global processing of the information they contain. Regarding this last function, it is important to point out that, thanks to the video and its adaptation by the teacher, students are able to learn values in an easier and more accessible way.

On the other hand, Sharma (2016) stresses the importance of the use of audio-visual aids in an educational context and outlines a sequence of beneficial outcomes they could provide in this context (see Fig. 3). In this regard, Sharma states that audio-visual aids may:

➢ Increase memory retention.
➢ Improve attention span.
➢ Create a focal point.
➢ Facilitate comprehension.
➢ Organize communication.

However, although the benefits of using videos may be numerous, this study will focus on the "motivational function" as outlined in the previous classification. In this regard, there are a great deal of authors who have

addressed this "motivational function" in their studies, such as Arroio (2010), Bianchi and Ciabattoni (2008), Herron, C., York, H., Corrie, C., & Cole, S. P. (2006), Ismaili (2013), Amin (2013), Rocillo (2014), Rodríguez (2013), Wilmot, P., Bramhall, M. & Radley, K. (2012), to name a few. Similarly, Adame (2009, p. 3) states that "audio-visual [aids] may produce an emotional impact which results in positive feelings towards learning, stimulating the attention and receptivity of the student".

Method

General and Specific Objectives

The general aim of the present study is to analyse the influence of the video on the motivation of students of history and science in a bilingual context. This research has been carried out in different bilingual educational centers in which the aforementioned subjects are taught. The specific objects established are:

- To measure student engagement through the use of videos.
- To evaluate students' attitudes towards learning in non-linguistic areas.
- To analyze students' motivation toward the study of history and science through the use of video resources.
- To estimate students' mindfulness and relaxation in the bilingual education context.
- To measure students' self-confidence in relation to the learning of content in bilingual lessons.

Context and Participants

This research was carried out in bilingual education centers where CLIL programmes were implemented: the public primary school Ginés de Sepúlveda and the semi-private school La Inmaculada in the province of Cordoba, Andalusia, Spain. Those students from the Ginés de Sepúlveda school were in fifth and sixth grade of primary education, whilst those

belonging to La Inmaculada school were in their third and fourth grade of primary education. According to Piaget (cited in Muñoz et al., 2011), these students belong to the concrete operational period, that is to say, from 8 to 11 years old.

Given that we are working in an educational context, the grade groups studied were randomly formed. The number of students belonging to the third, fourth, fifth and sixth grades of primary education were 23, 21, 19 and 22 respectively.

The total sample for this study was comprised of 85 students.

Procedure and Data Gathering

In this analytic research, a quantitative paradigm has been applied. Data collection took place during the first quarter of 2017/2018. The pedagogical treatment is based on two questionnaires divided into three parts:

• Part one: Considering that the purpose of this study is to analyse the use of videos as a complement to the subject rather than as a primary teaching tool, this part is based on three dichotomous yes-no questions regarding the frequency of the use of videos in lessons and their nature (series, films or short videos).

• Part two: Is based on multiple-choice questions. Students had to answer some questions about their perception of history and science subjects.

• Part three: Is based on nine Likert's scale questions. Students had to answer some questions about their usual behavior in lessons while using videos. Likert's scale is a type of scale used to measure the degree of agreement or disagreement of the survey respondent towards a series of questions with an affirmative or negative trend. It is mainly used to know the opinion or experience the user has had towards a certain activity or fact. Thus, in this scale, there will always be a minimum, which corresponds to a full disagreement, a neutral number, and a maximum by which the user surveyed expresses complete agreement with the statement that it arises.

Results and Discussion

In view of the objectives outlined above, the results obtained have been analysed using SPSS software. The results are displayed in the following graphs:
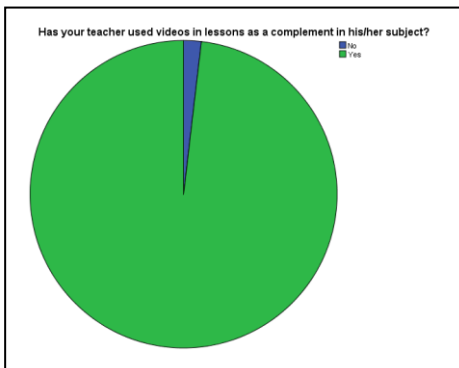
Figure 1. The use of videos in lessons: Ginés de Sepúlveda school
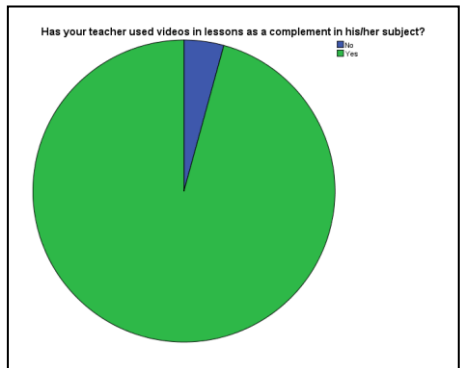
Figure 2. The use of videos in lessons: La Inmaculada school

These charts show that in both schools (Ginés de Sepúlveda and La Inmaculada) videos are used during lessons as a complement to the subject. Thus, both schools promote the use of educational methods which engage students and make learning stimulating (Dörnyei cited in Coyle, 2006). Accordingly, teachers from both schools also promote visual-spatial intelligence through the use of videos, thereby increasing motivation.
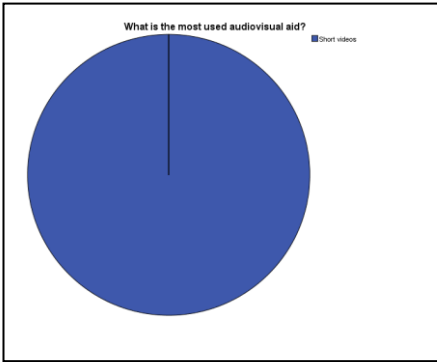
Figure 3. Audio-visual aids used in lessons: Ginés de Sepúlveda school
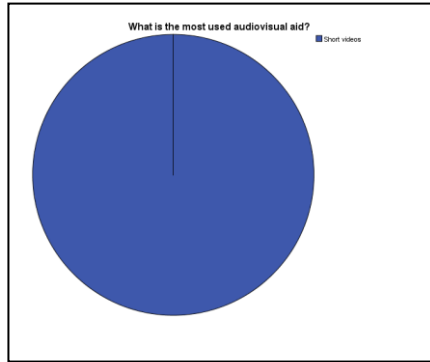
Figure 4. Audio-visual aids used in lessons: La Inmaculada school

Figures 3 and 4 demonstrate that most audio-visual aids used in lessons in both schools are short videos instead of series or films which may take longer to watch. Additionally, series or films require more time for preparation and selection of the content according to the students' age and level of English.
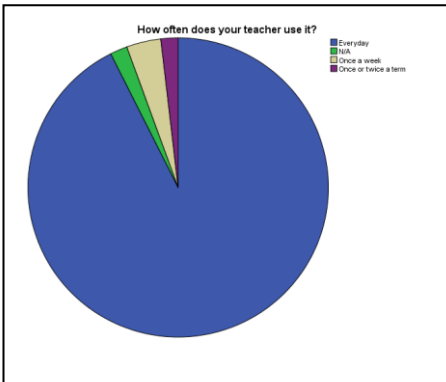
Figure 5. Frequency of the use of videos in lessons: Ginés de Sepúlveda school
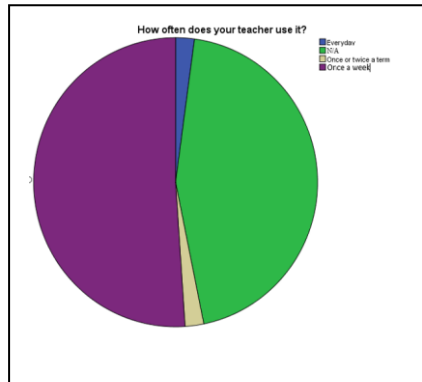
Figure 6. Frequency of the use of videos in lessons: La Inmaculada school

Regarding the frequency of the use of videos in lessons, figure 6 shows that in the fifth and sixth grades of primary education, videos are used every day. In contrast, in La Immaculada, videos are used once a week most of the time. Time constraints or even the perceptions of teachers towards videos in lessons may partly explain this result. This frequency should depend on the levels of anxiety in students and the comprehension of the content, among others.
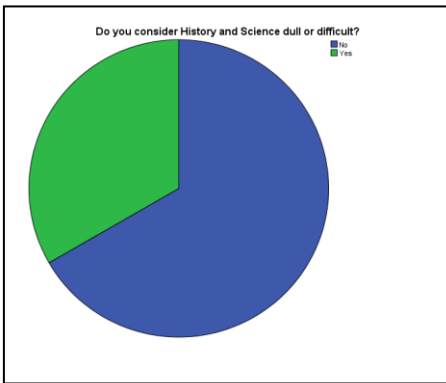
Figure 7. Perception of history and science subjects: Ginés de Sepúlveda school
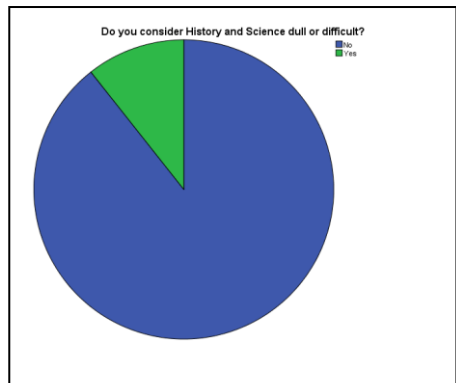
Figure 8. Perception of history and science subjects: La Inmaculada school

In relation to students' difficulties with history and science subjects, for some fifth and sixth grade primary school students, history and science may be quite difficult or dull. However, in both schools and grade groups most students do not consider these subjects as being challenging.
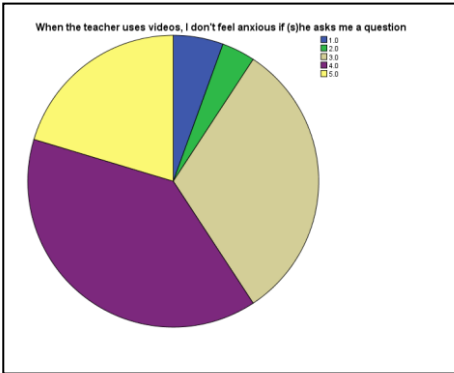
Figure 9. Anxiety during lessons when using videos: Ginés de Sepúlveda school
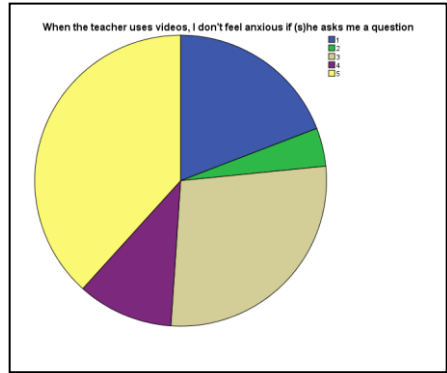
Figure 10. Anxiety during lessons when using videos: La Inmaculada school

According to figures 9 and 10, going from 1 (very anxious) to 5 (not anxious), most students in both schools and grade groups do not feel anxious if the teacher asks any questions while watching videos. However, there are some students in La Inmaculada (third and fourth grades) who disagree with this statement. Thus, we must take into consideration the variables proposed previously.
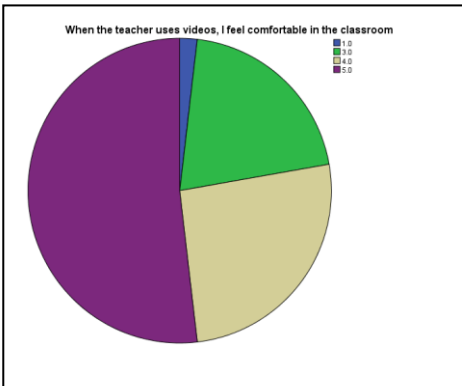
Figure 11. Comfort of students in classroom: Ginés de Sepúlveda school
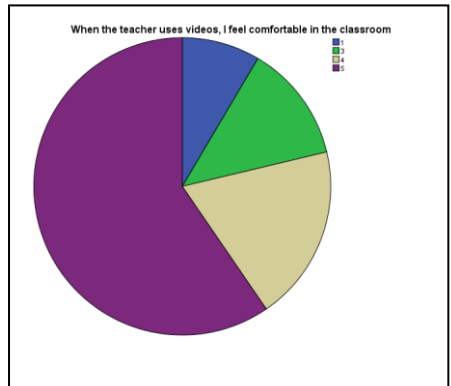
Figure 12. Comfort of students in classroom: La Inmaculada school

Figures 11 and 12, going from 1 (not comfortable) to 5 (very comfortable), show up that most students in both schools and grade groups feel comfortable in the classroom when videos are used during lessons. The students' comfort level during lessons is inversely proportional to the anxiety they may experience. Accordingly, the students' comfort level during lessons is a determining factor for increasing motivation.
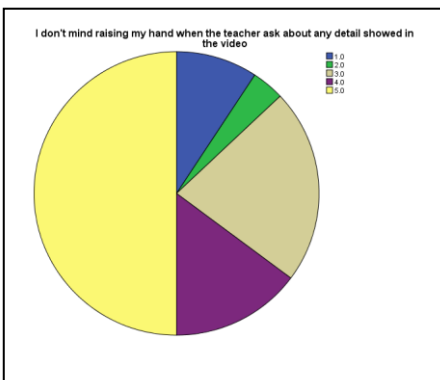
Figure 13. Participation of students: Ginés de Sepúlveda school
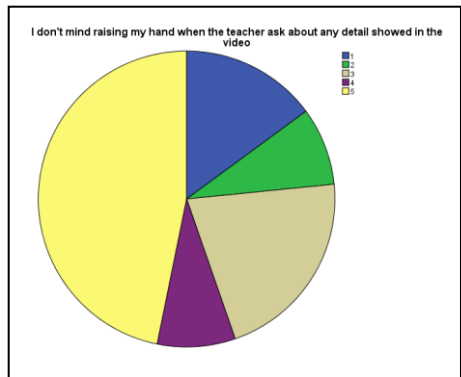
Figure 14. Participation of students: La Inmaculada school

Regarding the participation of students in lessons where videos are used, which is related to the students' comfort in the classroom, figures 13 and 14 show that the majority of primary school students from third to sixth grade usually participate and answer questions related to the videos. These findings are related to the need for self-confidence in students as one of the "requirements for stimulating learning" and one of the elements of intrinsic motivation (Keller, cited in Rudhumbnu, 2014, p. 89).
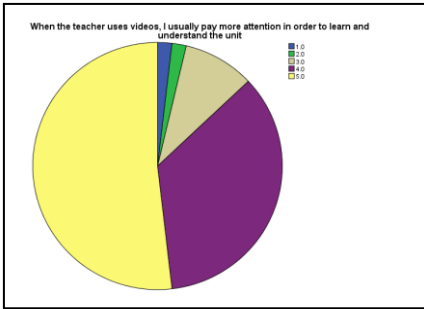
Figure 15. Determination of students to understand and learn: Ginés de Sepúlveda school
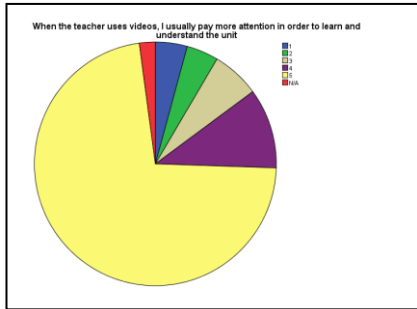
Figure 16. Determination of students to understand and learn: La Inmaculada school

Figures 15 and 16 show up that in both schools and grade groups the majority of students pay more attention to videos in order to understand and learn the concepts of the subjects. These findings are very important for students' learning process and for students' motivation, since they show that, in both schools, students understand and are aware of the purpose of watching videos: learning. Additionally, as videos require students to pay attention, by nature they require students' concentration. According to Keller (cited in Rudhumbnu, 2014, p. 89), this is a "requirement for stimulating learning" in intrinsic motivation.
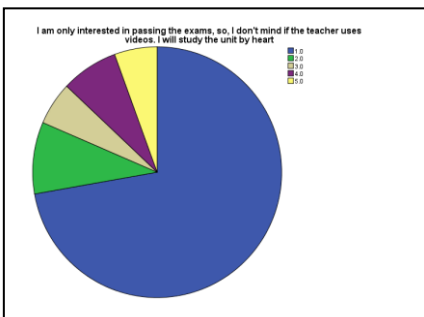
Figure 17. Determination of students while using videos: Ginés de Sepúlveda school
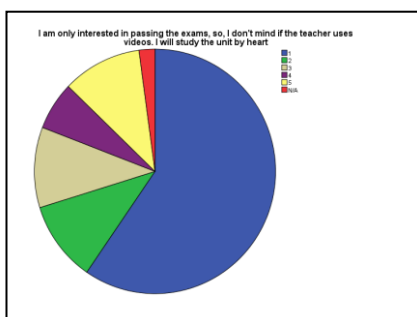
Figure 18. Determination of students while using videos: La Inmaculada school

Figures 17 and 18 demonstrate that most primary school students from third to sixth grade want to understand and learn through the use of videos as opposed to studying the concepts using the traditional method. These findings mean that students are interested in the subject, and, as highlighted previously, this interest has a direct impact on motivation. In other words, the desire to learn concepts related to the subject, and, especially, the desire to understand them, is connected to intrinsic motivation.
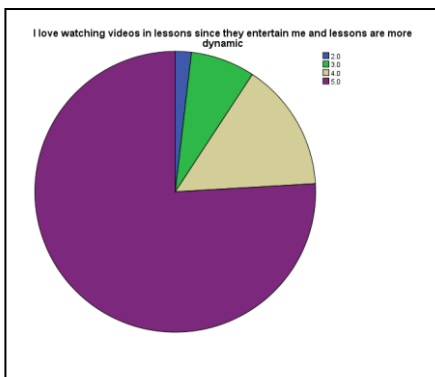
Figure 19. Students' perception of videos: Ginés de Sepúlveda school
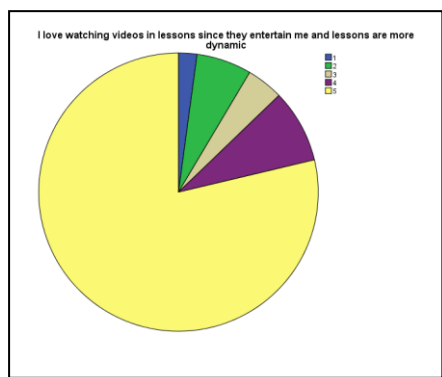
Figure 20. Students' perception of videos: La Inmaculada school

Figures 19 and 20 show students' perception towards videos in terms of entertainment and as a change from traditional lessons. Thus, most of the students, not only third and fourth grade primary students, but also fifth and sixth grade students, are interested in the use of videos. One of the main reasons for these findings could be the fact that videos are connected to students' spare time (Rodríguez, 2013). Additionally, one of the functions of videos identified by Ferrés (cited in Fandos, 1994) is the fun function, which has the effect of creating a sense of satisfaction among students, which in turn leads to motivation.
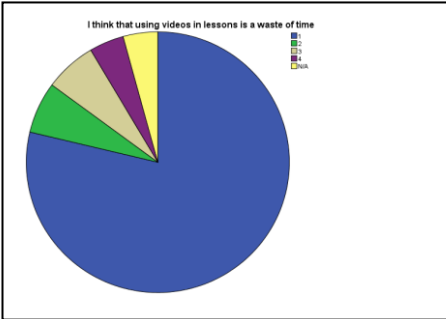
Figure 21. Perception of students towards the use of videos: Ginés de Sepúlveda school
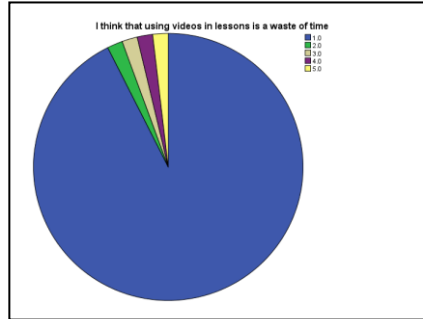

Figure 22. Perception of students towards the use of videos: La Inmaculada school

As can be observed in figures 21 and 22, the majority of primary school students from third to sixth grade do not consider the use of videos as a waste of time. These findings are correlated to those in figures 17 and 18, in which the need for attracting the attention of students is very important in intrinsic motivation. Additionally, making students aware of the objective of the videos changes their perception towards them and towards the subject.
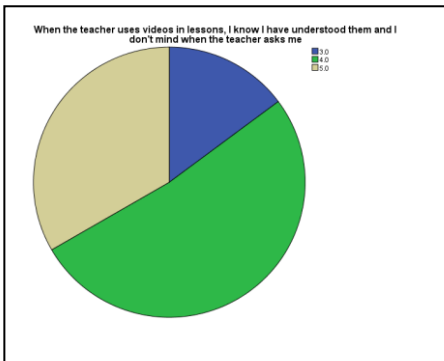
Figure 23. Behaviour of students when using videos: Ginés de Sepúlveda school
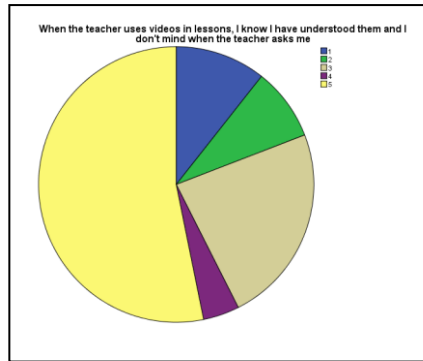
Figure 24. Behaviour of students when using videos: La Inmaculada school

Figures 23 and 24 show that most primary school students from third to sixth grade focus on the video which is played during lessons instead of starting to talk with their classmates. These findings are related to those in figures 13, 14, 21 and 22. Capturing and maintaining students' attention is an important step towards intrinsic motivation. For this reason, it is important to consider students' behavior and attention during the visualization of videos.
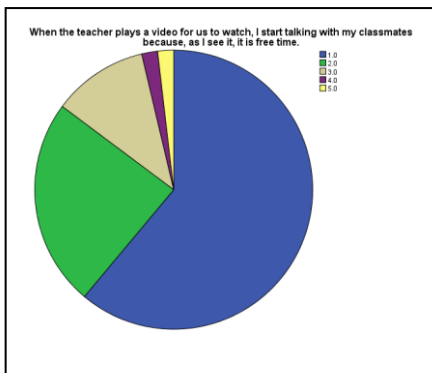

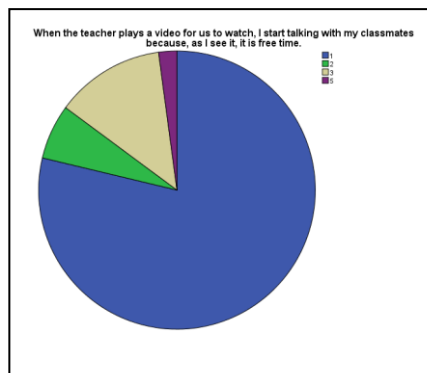*Figure 25*. Confidence of students when using videos: Ginés de Sepúlveda school

Figure 26. Confidence of students when using videos: La Inmaculada school

Figures 25 and 26 show that the majority of students surveyed are confident that they have understood and learned from what has been shown in the video. These findings are also related to those in figures 15 and 16, namely that self-confidence is the key to increasing intrinsic motivation in students, and, consequently, to facilitating the learning of both content and language. However, in La Inmaculada School, although the vast majority agrees with the students from Ginés de Sepúlveda, there are certain students who either have not fully understood the concept shown, or who have not understood anything explained in the video. For this reason, it is necessary to consider the variables mentioned above in relation to the students. It is also important to take into account the fact that the results of students from La Inmaculada (third and fourth grade primary school students) are very similar to those from Ginés de Sepúlveda (fifth and sixth grades). However,

they do differ on occasions, for example, when considering the frequency in which videos are used. Regarding the theory that history and science may be difficult or dull for students, as has been demonstrated by the results, students do not see these subjects as tough or difficult. One of the reasons why this is the case is, likely to be, due to the methodology used in these two schools: Ginés de Sepúlveda and La Inmaculada. Additionally, in both schools the use of videos is strongly encouraged, thereby making these two subjects easier as a result. With regards the objective of measuring the students' positive engagement through the use of videos, we can conclude, with reference to figures 25, 19 and 20, that students consider videos as entertaining. Thus, students feel more motivated when videos are used.

In relation to the objective of evaluating students' attitude towards learning in non-linguistic subject areas, the results shown in figures 15 and 16, 17 and 18 reveal that most students agree with this statement. As a result, this interest implies a positive attitude and motivation on the part of students when learning history and science. With regards the objective of estimating students' mindfulness and relaxation in the bilingual education context, the results presented in figures 11 and 12 show that videos may reduce anxiety and stress derived from factors such as the non-understanding of concepts or the relationship between student and teacher during lessons, with the result being that students feel more relaxed. Mindfulness involves maintaining an awareness of our thoughts and feelings, students learning through the use of videos pay attention to the present moment and learn the concepts presented to them. Finally, regarding the objective of measuring students' self-confidence in relation to content learning in bilingual lessons through the use of videos, students agree with the statement, as displayed in the results presented in figures 9, 10, 13, 14, 25 and 26. Thus, as was highlighted in the theoretical background, self-confidence is strongly linked to motivation in learners. Therefore, we may conclude that the use of videos is highly recommended if teachers want to motivate their students and improve their self-confidence. Finally, it is important to point out that the primary purpose of using videos during lessons, as has been displayed in the results, is that of illustrating concepts that the students may not have understood. Therefore,

this result reinforces the idea that the use of videos is a complement to and tool for the subject.

Conclusions

In view of the results obtained and the literature reviewed in this study, we can conclude that videos are well-received by teachers as a teaching complement in history and science subjects with the purpose of reinforcing concepts in order to aid understanding. We conclude that the use of video is capable of increasing students' interest in the subject and in aiding learning, both of which are important factors in determining motivation. This finding was also underlined by Bravo, E., Amante, B., Simo, P., Enache, M. & Fernandez, V. (2011) in their study about the impact of videos and ICTs (Information and Communication Technologies) on students' motivation. Similarly, as a direct consequence of motivation, it has been proven that learners are able to have fun in history and science lessons thanks to the use of videos. Additionally, the use of videos increases students' self-confidence with regards the knowledge they have learned about a topic. This characteristic is also pointed out by Gardner (2007) when considering the external factors linked to motivation.

Consequently, we can conclude that all of these factors (motivation, interest and self-confidence) create a relaxed and comfortable environment where students can study and work, a finding that Ismaili (2013) also identified in a study on the benefits of using movies in EFL (English as a Foreign Language) classrooms. Using videos in non-linguistic areas, such as history and science, provides students with a mindfulness experience that allows them to be attentive and to understand concepts and ideas in the L2. Video resources also provide a means of interactive instruction; this reduces anxiety levels in students and the corresponding negative consequences of anxiety on learning. In light of the results obtained in this study, we argue that the use of videos has motivational and beneficial effects on the comprehension, interest and learning of history and science subjects.

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Communicative Competence, Classroom Interaction, and Educational Equity. The select works of Courney Cazden.

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Review

Cazden, B. Courtney (2018) *Communicative Competence, Classroom Interaction, and Educational Equity. The select works of Courney Cazden*. New York: Taylor & Francis Group. ISBN: 978-1-138-20628-1

Courtney B. Cazden, profesora emérita en la Universidad de Harvard y reconocida sociolingüista educativa, publica a sus 91 años *Communicative Competence, Classroom Interaction, and Educational Equity*, un libro con el que facilita una selección de su trabajo como investigadora en educación sobre el desarrollo de habilidades orales y escritas y las funciones del lenguaje en la escuela y la comunidad. Un reconocimiento a su labor y a su visión, que ella insiste en dirigir hacia el propósito de la investigación educativa; *estudiar, trabajar y cambiar la práctica diaria de docentes y estudiantes en las aulas*. El libro recopila 18 de las publicaciones más importantes desarrolladas durante 50 años dedicados a la investigación y a la enseñanza y que, como ella mismo constata, es fruto de un diálogo intercultural e intergeneracional.

La obra narra cómo realizó el trabajo que hay detrás de sus publicaciones; conversaciones y colaboraciones interdisciplinares sobre los temas centrales de su investigación en el campo de la etnografía de la comunicación. Ésta se divide en tres temas a través de los cuáles se puede seguir el hilo del trabajo desarrollado desde 1973 hasta 2013.

La primera sección la denomina "Competencia comunicativa". Incluye los primeros trabajos sobre dicho concepto y la evolución a la que la llevó su propio estudio. Primero, expone el interés por mostrar cómo el alumnado desarrolla y utiliza el lenguaje, es decir, su competencia comunicativa, y su relación con el éxito académico. Su análisis desarrolla a través del estudio de diferentes aspectos; la capacidad del maestro, la diversidad dentro de una misma lengua y su repercusión en el discurso del aula, así como, los

problemas a los que se enfrenta el alumnado cuya variedad lingüística se encuentra alejada del discurso del aula. Esta repercusión es lo que hace que centre su atención en el proceso de socialización en relación a la variedad lingüística adquirida.

En la segunda sección "Interacciones en el aula" trata el trabajo que realizó en combinación con su ocupación como maestra que coincidió cuando volvió a la escuela en San Diego (durante los años 1974-75). El trabajo que desarrolló en este periodo lo considera fruto de un aprendizaje debido a la vuelta a las aulas unido al proceso de investigación, lo cual le provocó un cambio en el enfoque en su enseñanza e investigación en su retorno a Harvard en 1975. Este cambio supuso que, además de que su atención se situara en cómo el alumnado desarrolla el lenguaje a nivel individual, también lo focalizara en estudiar cómo puede ser estimulado o expresado en función del discurso del aula. De esta forma, se centró en la relevancia de las interacciones en el aula, profundizando en aquellas que contribuyen a un mayor desarrollo. En 1983, tras su primer viaje al Pacífico, que supondría el inicio de muchos más hasta el 2013, su trabajo se ve influenciado por las colaboraciones que allí realizó, y que iba a suponer incluir en sus análisis el concepto cultura en la educación formal: tanto la cultura del alumnado, como la del docente, así como, la cultura que se crea en cada comunidad educativa.

La tercera y última sección la dedica a la "Justicia social". Podríamos decir que se trata de un tema transversal a toda su trayectoria. Ya desde sus inicios estuvo implicada en el Sindicato de Docentes de Nueva York que entre 1916-1964 lideró importantes luchas antirracista y antisemitas, defendiendo la educación como herramienta de transformación de las desigualdades. También formó parte en los inicios de los programas preescolares Head Start y Barrio Sésamo en los que temas como lenguaje, clase social y diversidad cultural fueron centrales a través de la reforma educativa de la "Guerra contra la Pobreza". El trabajo que realizó en Australia con la población indígena también la llevó a profundizar en el marco de la Justicia Social y el papel de la educación.

Recomiendo encarecidamente su lectura, por su gran valor académico al que acompañan referencias históricas. Un libro que muestra la visión

ecléctica de su trabajo y que, con todo, evidencia las mejoras conseguidas en la vida de muchas niñas y niños.

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