Programa de Doctorado en Deporte y Salud

Estilo interpersonal de apoyo a la autonomía y sus efectos en estudiantes universitarios

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La presente Tesis Doctoral, titulada "Estilo interpersonal de apoyo a la autonomía y sus efectos en estudiantes universitarios", se presenta con el indicio de calidad, bajo la modalidad de **tesis por compendio** de las siguientes **publicaciones**:

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El Dr. D. *Juan Antonio Moreno Murcia*, Doctor en Psicología y Profesor Titular de Universidad Miguel Hernández de Elche, director de la tesis, y la Dr. Dña. Elisa Húescar Hernáncez, Doctora y Profesora Titular de Universidad de la Universidad Miguel Hernández de Elche, codirectora de la tesis doctoral titulada *"Estilo interpersonal de apoyo a la autonomía y sus efectos en estudiantes universitarios"*,

INFORMAN

Que D. *José Eduardo Lozano Jiménez*, ha realizado bajo nuestra supervisión el trabajo titulado *"Estilo interpersonal de apoyo a la autonomía y sus efectos en estudiantes universitarios",* conforme a los términos y condiciones definidos en su Plan de Investigación y de acuerdo al Código de Buenas Prácticas de la Universidad Miguel Hernández de Elche, cumpliendo con los objetivos previstos de forma satisfactoria para su defensa pública como tesis doctoral.

Lo que firmamos para los efectos oportunos, en Elche a _*15*_ de _febrero_ de dos mil veintidós.

Director de la tesis
Dr. D. *Juan Antonio Moreno Murcia*

Codirectora de la tesis
Dra. Dña. *Elisa Huéscar Hernández*

El Dr.D. Francisco Javier Moreno Hernández, coordinador del Programa de Doctorado en Deporte y Salud de la Universidad Miguel Hernández de Elche,

INFORMA:

Que D. *José Eduardo Lozano Jiménez* ha realizado bajo la supervisión de nuestro programa de doctorado el trabajo titulado *"Estilo interpersonal de apoyo a la autonomía y sus efectos en estudiantes universitarios",* conforme a los términos y condiciones definidos en su Plan de Investigación y de acuerdo al Código de Buenas Prácticas de la Universidad Miguel Hernández de Elche, cumpliendo con los objetivos previstos de forma satisfactoria para su defensa pública como tesis doctoral.

Lo que firmo para los efectos oportunos, en Elche a ____ de _febrero_ de dos mil veintidós.

Prof. Dr. D.Francisco Javier Moreno Hernández
Coordinador del Programa de Doctorado en Deporte y Salud

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Listado de abreviaturas

AA Apoyo a la Autonomía
EAA Escala de Apoyo a la Autonomía
EMEC. Escala de Medición del Estilo Controlador
IES. Instituciones de Educación Superior
NPB. Necesidades psicológicas básicas
TAD Teoría de la Autodeterminación

Resumen

La formación en estudios superiores representa grandes desafíos tanto para la sociedad en su conjunto como para las personas que se proponen obtener un título universitario. De los múltiples aspectos que se involucran en este proceso, la motivación es un componente clave, en cuanto elemento predictor de la adherencia a los procesos de estudio, del desempeño académico, la implicación, la satisfacción con la vida e incluso el éxito profesional futuro. El proceso motivacional es por naturaleza intrínseco y autorregulado, y aunque varía según su locus de causalidad o su tipo de regulación, puede ser potenciado por desencadenantes sociales que, en el caso de los escenarios de educación superior, corresponden al papel que desempeña el profesor durante el proceso de enseñanza-aprendizaje, toda vez se desenvuelva desde un ejercicio docente basado en un estilo interpersonal motivacional de apoyo a la autonomía, capaz de potenciar la motivación intrínseca a través de la satisfacción de las necesidades psicológicas básicas de sus estudiantes.

El presente estudio se propone establecer los posibles efectos del estilo interpersonal de apoyo a la autonomía del docente sobre la motivación académica de los estudiantes de educación superior. Para tal fin, se aplicó un programa de intervención de apoyo a la autonomía en un contexto universitario, con el objetivo de formar a los profesores en prácticas propias del estilo interpersonal de apoyo a la autonomía y de potenciar la motivación de los estudiantes. Aunque hay suficiente evidencia en la literatura científica sobre la efectividad de estos programas y los modelos teóricos que los sustentan, en Colombia aún no son conocidos ni implementados en el contexto de la educación superior, por lo que sea hace necesario y pertinente adelantar investigaciones en esta dirección que den respuesta a los desafíos que

enfrenta la universidad en su propósito de alcanzar la alta calidad y permitan desarrollar nuevas líneas de investigación en el área.

Abstract

University education represents great challenges both for society as a whole and for people who intend to obtain an academic degree. In this process, motivation is a key component, as a predictor of adherence to study processes, academic performance, involvement, satisfaction with life, and even future career success. The motivational process is by nature intrinsic and self-regulated, and although it varies according to its locus of causality or its type of regulation, it can be enhanced by social triggers that, in the case of higher education settings, correspond to the role played by the teacher during the teaching-learning process from their teaching practice based on a motivational interpersonal style autonomy support, capable of promoting intrinsic motivation through the satisfaction of basic psychological needs.

The present study aims to establish relationships between the teacher´s interpersonal style of autonomy support and its effects on the academic motivation of higher education students. For this purpose, an intervention program based on autonomy support was applied in a university context, with the aim of training teachers in practices of the interpersonal style of autonomy support and enhancing the motivation of students. Although there is sufficient evidence collected in the scientific literature on the effectiveness of these programs and the theoretical models that support them, in Colombia they are not yet known or implemented in the context of higher education, so it is necessary and pertinent to carry out research in this direction that respond to the challenges faced by the university in its purpose of achieving high quality and allow the development of new lines of research in the area.

Introducción

En el proyecto personal de vida la formación académica universitaria juega un papel preponderante. Alcanzar un título profesional en el marco de la sociedad del conocimiento (García-Peñalvo, 2020) depende, en principio, de la estructura con la que cuentan las Instituciones de Educación Superior (IES) en su propósito de alcanzar la alta calidad (Al Abduwani, 2017), así como de otras variables, entre ellas, las asociadas directamente a los estudiantes y que representan, a su vez, condiciones básicas asociadas a la calidad (Gutiérrez, Mondragón, & Santacruz, 2019). De esta forma, los factores personales afectan las probabilidades de que los estudiantes cursen y concluyan exitosa y oportunamente sus estudios (Alban, & Mauricio, 2019) y, en buena medida, marcan la ruta de su posterior futuro profesional (Reynoso, & Méndez-Luévano, 2018). En particular, la motivación es una variable que gana un lugar central en el análisis de los aspectos a considerar por las IES para alcanzar o mantener su calidad, en cuanto incide directamente en el nivel de implicación, la permanencia y el rendimiento académico de los estudiantes; aspectos que hoy por hoy constituyen un escenario de problema cada vez más relevante para las universidades, tanto en América Latina como en los países desarrollados (Viloria, Senior, Hernández, Niebles, & Niebles, 2020).

Diversos estudios reconocen la motivación como un elemento determinante para alcanzar la implicación, la permanencia y el buen desempeño académico de los estudiantes universitarios (Robayo-Tamayo, Blanco-Donoso, Roman, Carmona-Cobo, Moreno-Jimenez, & Garrosa, 2020), así como para la percepción de satisfacción con la vida (Gutiérrez, Tomás, & Calatayud, 2017) y la percepción de un posterior éxito profesional (Ortega, 2010).

Si bien es cierto que la motivación es en sí misma una tendencia natural de las personas, basada en el deseo de experimentar libertad psicológica y sentido de elección (Ryan y Deci, 2000) y en cuanto tal es un determinante individual (Fomunyam, & Mnisi, 2017), también lo es que los desencadenantes sociales pueden potenciarla. La Teoría de la Autodeterminación, (SDT, Ryan y Deci, 2000) postula, en general, que los contextos sociales son clave para generar un mayor bienestar (Ryan & Deci, 2017). En los contextos académicos, en particular, la manera en la que los profesores interactúan con sus estudiantes constituye un componente central de la TAD. En los escenarios de enseñanza, el papel del profesor puede constituirse en un poderoso desencadenante social capaz de impulsar efectos adaptativos, a través de determinados estilos interpersonales (Leenknecht et al., 2017). La capacidad del profesor para potenciar la motivación autodeterminada en sus estudiantes, mediante un estilo interpersonal de apoyo a la autonomía, es clave para promover en ellos una mayor implicación, un mayor logro en sus procesos académicos, así como una mayor satisfacción con la vida (Leenknecht et al., 2017; Zamzami, & Corinne, 2019).

Los profesores que desarrollan sus clases con un estilo de apoyo a la autonomía tienen estudiantes que cuentan con más oportunidades para ser proactivos y jugar un papel de liderazgo en el aula (Vermote et al., 2020), ya que presentan una mayor satisfacción de sus necesidades psicológicas básicas (Frielink, Schuengel, & Petri, 2018), alcanzando una mayor motivación intrínseca (Ryan, & Deci, 2000). En contraste, un estilo controlador por parte del profesor está asociado con un incremento en la desmotivación de los estudiantes (Martinek, Zumbach, & Carmignola, 2020).

De que el estilo interpersonal docente de apoyo a la autonomía genera un impacto positivo en el contexto académico hay suficientes evidencias. En principio, facilita en los

estudiantes la satisfacción de las necesidades psicológicas básicas de autonomía, competencia y relación con los demás, y a partir de ello potencia en ellos una mayor motivación intrínseca y un mayor bienestar (Bronson, 2016; Griffin, 2016). Lo anterior se traduce en una mayor permanencia y desempeño académico (Leenknecht et al., 2017), así como en un mayor aprendizaje (Griffin, 2016) y compromiso con sus estudios (Bronson, 2016) e incluso un futuro profesional exitoso (Reynoso, & Méndez-Luévano, 2018).

De esta manera, aunque los estudiantes son los protagonistas y responsables directos de asumir y apropiar los procesos académicos en su ruta formativa, también los profesores se constituyen en agentes determinantes para propiciar experiencias significativas en el aula para potenciar su motivación (Vansteenkiste, Aelterman, Haerens, & Soenens, 2019).

Reconocida la relevancia del rol del profesor, como desencadenante social de la motivación en los estudiantes, éste debe centrarse en el aprendizaje, apropiación e implementación de unas pautas específicas de comportamiento que le permitan desarrollar un estilo interpersonal de apoyo a la autonomía, orientado a potenciar en el aula la satisfacción de las NPB de sus estudiantes. En ese sentido, el profesor deberá, en general, garantizar un grado suficiente de libertad para que sus estudiantes puedan autodeterminarse durante las clases a través de la toma de decisiones frente a asuntos tocantes al desarrollo de la asignatura (Autonomía); proveer a sus estudiantes de la información, las orientaciones y el acompañamiento adecuado, claro y suficiente, respecto a cómo alcanzar los resultados propuestos en el aula (Competencia); y promover un relacionamiento abierto, cercano, respetuoso y horizontal tanto de él hacia los estudiantes como de ellos entre sí (Relación con los demás) (Cheon et al., 2020; Hospel, & Galand, 2016). De esta forma, se configura un escenario integral de apoyo a la autonomía.

Aunque cada vez es mayor el espacio y la proyección que gana la investigación basada en la TAD en los escenarios de educación superior, así como su impacto al promover prácticas docentes en el aula basadas en la apropiación de un estilo de apoyo a la autonomía, en Colombia no se conocen desarrollos en torno a programas de intervención basados en la TAD, en el marco de los procesos orientados a la alta calidad en las Instituciones de Educación Superior y liderados por el Consejo Nacional de Acreditación (CNA). No obstante, sí existe un interés por reconocer la necesidad de implementar planes de formación continua para el profesorado, en los que se desarrollen diversos aspectos como el uso de tecnologías, el modelo pedagógico e innovaciones docentes.

En consonancia con lo anterior, el desarrollo de programas de intervención basados en la TAD y orientados a fomentar el apoyo a la autonomía en las clases de programas universitarios, tendría un doble impacto en los procesos de calidad. De una parte, sería respuesta a la expectativa del sector de la educación superior ante el desafío de promover la formación integral de los profesores; y, por otra, se constituiría en una alternativa de solución frente a los fenómenos de la deserción, el bajo desempeño y la poca implicación de los estudiantes, derivados de sus dinámicas personales motivacionales dentro de su proceso formativo. Además, el desarrollo de programas de intervención en esta dirección permitiría abrir nuevas líneas de investigación en motivación.

En atención a la necesidad y la importancia de contribuir con estudios que posibiliten comprender y, sobre evidencia científica, argumentar la pertinencia de consolidar la implementación de ambientes de aprendizaje orientados a promover la satisfacción de las NPB y en consecuencia potenciar la motivación intrínseca y con ella la implicación, la permanencia y el logro académico en estudiantes universitarios, se adelantó un proceso investigativo que se

condensa en 4 artículos, en el marco de la línea de investigación en Estudio de los factores motivaciones contextuales y situacionales, de la Universidad Miguel Hernández de Elche.

Como lo recoge su título general, la investigación se propuso analizar los efectos del estilo interpersonal de apoyo a la autonomía en estudiantes universitario. En esa ruta se comprobó la capacidad predictiva del estilo interpersonal docente de apoyo a la autonomía, y la consistencia y la perseverancia subjetiva, sobre la satisfacción de las NPB, la motivación intrínseca, la cohesión grupal y la satisfacción con la vida, en estudiantes de educación superior (artículo 1).

Partiendo de esa base y habiéndose comprobado que el estilo interpersonal de apoyo a la autonomía y el grit explicaron positivamente la satisfacción de las necesidades psicológicas básicas, y éstas la motivación intrínseca, lo que predijo a su vez una mayor satisfacción con la vida, mediada por la cohesión grupal, se adelantó un experimento, que se propuso analizar la influencia de una intervención basada en el estilo interpersonal docente de apoyo a la autonomía sobre la motivación de los estudiantes y su nivel de implicación en su proceso formativo (artículo 2).

Yendo un poco más allá, se proyectó relacionar, a partir de un modelo de ecuaciones estructurales, el estilo interpersonal de AA, con las características motivacionales de los estudiantes, los procesos de estudio, las percepciones de la competencia profesional y la satisfacción con la vida (artículo 3).

Por último, explorando recursos alternativos para adelantar los análisis de los datos, se exploraron las relaciones predictivas entre la satisfacción de las NPB, la motivación académica, los procesos de estudio y la competencia académica y laboral, con el fin de establecer un

modelo capaz de predecir el éxito académico; mediante la técnica de machine learning random forest.

Atendiendo a la revisión teórica y a los antecedentes de la literatura científica se planteó la tesis, sobre la base de la Teoría de la Autodeterminación, con el objetivo de formular y desarrollar un programa de intervención, basado en el estilo interpersonal docente de apoyo a la autonomía, así como de medir sus efectos en estudiantes universitarios.

Objetivos

Objetivo 1.

Comprobar la capacidad predictiva que tienen el estilo interpersonal docente de apoyo a la autonomía, y la consistencia y la perseverancia subjetiva, sobre la satisfacción de las NPB, la motivación intrínseca, la cohesión grupal y la satisfacción con la vida, en estudiantes de educación superior.

Objetivo 2.

Adelantar una intervención experimental basada en la TAD, para analizar la posible la influencia del estilo interpersonal docente de apoyo a la autonomía sobre la motivación de los estudiantes y su nivel de implicación en su proceso formativo.

Objetivo 3.

Examinar las relaciones entre el apoyo a la autonomía del instructor para el aprendizaje de los estudiantes y las características motivacionales de los estudiantes, los enfoques de aprendizaje, las percepciones de la competencia profesional y la satisfacción con la vida.

Objetivo 4.

Determinar el mejor modelo posible capaz de predecir el éxito académico en estudiantes universitarios a partir de la satisfacción de las necesidades psicológicas básicas, la motivación académica, los procesos de estudio, y la competencia académica y social percibidas.

Métodos

El primer estudio contó con la participación de un grupo compuesto por 489 estudiantes universitarios, 381 chicas y 108 chicos, con edades comprendidas entre los 18 y los 41 años (*M* = 21.93; *DT* = 3.58), matriculados en el programa de psicología de una universidad privada de la ciudad de Barranquilla, al norte de Colombia. La muestra del segundo estudio estuvo compuesta por 220 estudiantes universitarios colombianos, 144 chicas y 76 chicos, con edades comprendidas entre los 18 y 39 años (*M* = 20.76; *DT* = 3.10), matriculados en distintos niveles y programas académicos de pregrado de una universidad privada de la ciudad de Barranquilla, al norte de Colombia. Estuvieron distribuidos así: 37 en 3er nivel; 22 en 4º nivel; 62 en 5º nivel; 29 en 6º nivel; 38 en 7º nivel; 13 en 8º nivel y 18 en 9º nivel. Los estudiantes participantes en la investigación se dividieron en un grupo de intervención (n = 113), compuesto por 59 hombres y 54 mujeres, y un grupo de control (n = 107), con 17 hombres y 90 mujeres. En el segundo estudió también participaron 24 profesores universitarios, 11 hombres y 13 mujeres, asignados al desarrollo de asignaturas de distintos niveles y programas académicos de pregrado de la misma universidad, con edades comprendidas entre los 25 y lo 56 años (*M* = 34.83; *DT* = 7.55). También fueron divididos en un grupo de intervención, capacitado para impartir clases de apoyo a la autonomía (n = 12), compuesto por 5 hombres y 7 mujeres, y un grupo de control, que utilizaba el modelo de clase tradicional (n = 12), compuesto por 6 hombres y 6 mujeres. En el tercer estudio participaron 1.048 estudiantes de diversas universidades españolas con edades comprendidas entre los 18 y los 57 años. En el cuarto estudio participaron 1172 estudiantes universitarios (405 hombres y 767 mujeres) pertenecientes a diferentes universidades españolas, con edades comprendidas entre los 18 y los 57 años (*M* = 22.15, *DT* = 4.22).

Los instrumentos utilizados de conformidad con los objetivos de cada estudio fueron los siguientes:

Apoyo a la autonomía. Para medir el estilo interpersonal de apoyo a la autonomía que percibe el estudiante de Educación Superior de su docente, se utilizó la *Escala de Apoyo a la Autonomía* (EAA) de Moreno-Murcia et al. (2019). Consta de 12 ítems (e.g. "Proporciona explicaciones que nos ayudan a comprender la utilidad personal de realizar dicha actividad") y la escala comienza con un encabezado introductorio como: "Mi docente en clase...". Esta se valora en una escala Likert de 1 (*Totalmente en desacuerdo*) a 5 (*Totalmente de acuerdo*).

Grit. Se empleó la escala *Short Grit Scale* de Duckworth y Quinn (2009), compuesta por 8 ítems, validada al castellano por Marentes-Castillo, Zamarripa, y Castillo (2019). Este instrumento consta de dos dimensiones: consistencia de intereses (e.g. "Con frecuencia, me pongo una meta, pero luego sigo otra") y perseverancia del esfuerzo (e.g. "Los contratiempos no me desaniman"). La sentencia que precede a estos ítems es "En mi asignatura…" y las respuestas se valoran en una escala tipo Likert de cinco puntos, entre 1 (*Totalmente desacuerdo*) y 5 (*Totalmente de acuerdo*).

Necesidades psicológicas básicas. Se utilizó la versión en castellano de la *Échelle de Satisfacción des Besoins Psychologiques* en el contexto educativo (León et al., 2011) de Gillet et al. (2008). La escala estaba precedida por el enunciado "En mi clase..." y compuesta por 15 ítems referidos a la competencia académica (e.g. "Tengo la sensación de hacer las cosas bien"), a la autonomía académica (e.g. "Generalmente me siento libre para expresar mis opiniones"), y a la relación con los demás académica (e.g. "Me siento bien con las personas con las que me relaciono"). Las respuestas se establecían en una escala tipo Likert que oscilaba de 1 (*Totalmente en desacuerdo*) y 5 (*Totalmente de acuerdo*).

Motivación intrínseca. Para medir la motivación del estudiante se empleó la subescala de motivación intrínseca de la versión traducida y validada al castellano de Núñez, Martín-Albo et al. (2005) de la *Échelle de Motivation en Éducation* (EME) (Vallerand et al., 1989). La dimensión está compuesta por cuatro ítems (e.g. "Por el placer que siento al ampliar mis conocimientos sobre temas que me interesan"). Está precedida por la frase "¿Por qué estudias esta asignatura?" y las respuestas son recogidas en una escala tipo Likert que oscila de 1 (*Totalmente en desacuerdo*) a 7 (*Totalmente de acuerdo*).

Motivación Académica. Para medir la motivación académica del estudiante se empleó la versión española traducida y validada para la enseñanza secundaria (Suárez, 2008) de la *Academic Motivation Scale*, High SchoolVersion (AMS-HS-28) (Vallerand, Pelletier, Blais, y Brière, 1992). El instrumento está formado por 28 ítems, precedidos por la frase "¿Por qué estudias?" y distribuidos en siete subescalas cinco de ellas de cuatro ítems y las dos restantes de tres: desmotivación (e.g. "No sé por qué voy al instituto y, sinceramente, no me importa"), regulación externa (e.g. "Para poder conseguir, posteriormente, un mejor salario"), regulación introyectada (e.g. "Porque cuando hago bien las tareas en clase me siento importante"), regulación identificada (e.g. "Porque me ayudará a tomar una mejor decisión en lo que respecta a mi orientación profesional"), motivación intrínseca al conocimiento (e.g. "Porque mi estudios me permiten seguir aprendiendo muchas cosas que me interesan"), motivación intrínseca al logro (e.g. "Por la satisfacción que siento cuando voy superando actividades académicas difíciles") y motivación intrínseca a las experiencias estimulantes (e.g. "Porque realmente me gusta asistir a clase"). Las respuestas se puntuaron de acuerdo a una escala tipo Likert de siete puntos, desde 1 (*no se corresponde en absoluto*) hasta 7 (*se corresponde totalmente*).

Cohesión grupal. Para valorar la cohesión grupal se utilizó la escala de cohesión grupal de Chin, Salisbury, Pearson, y Stollak (1999). Está compuesta por 6 ítems (e.g. "Siento que pertenezco a este grupo") precedidos por la frase "En esta asignatura, cuando trabajo en pequeños grupos...".

Satisfacción con la vida. Se utilizó la Escala de Satisfacción con la Vida (ESDV-5) de Vallerand et al. (1989), validada al castellano por Atienza et al. (2000) y Atienza et al. (2003). Está formada por cinco ítems para valorar el factor satisfacción con la vida (e.g. "Estoy satisfecho con mi vida"). La sentencia previa es "Satisfacción con tu vida..." y las respuestas son recogidas en una escala tipo Likert que oscila de 1 (*Totalmente en desacuerdo*) a 7 (*Totalmente de acuerdo*).

Estilo controlador. Para medir el estilo interpersonal controlador que percibe el estudiante de Educación Superior de su docente, se utilizó la *Escala de Medición del Estilo Controlador (EMEC)* de Moreno-Murcia et al. (2018). Consta de 12 ítems (e.g. "Da directrices muy escasas y sin alternativas de cómo realizar las tareas que presenta") y la escala comienza con un encabezado introductorio como: "Mi docente en clase...". Esta se valora en una escala Likert de 1 (*Totalmente en desacuerdo*) a 5 (*Totalmente de acuerdo*).

Implicación. Para valorar la implicación se utilizó la escala de Núñez, J. L., & León, J. (2019). Está compuesta por 12 ítems, que se puntúan en una escala Likert de 1 (Absolutamente en desacuerdo) a 7 (Totalmente de acuerdo).

Procesos de estudio. En este estudio se utilizó el Cuestionario Revisado de Procesos de Estudio: R-CPE-2F, Recio & Cabrero, 2005. El instrumento contiene diez ítems que evalúan el interés profundo en el aprendizaje con dos subescalas que evalúan la motivación profunda para aprender y las estrategias de aprendizaje profundo. Hay una pregunta básica común en ambas

subescalas para cada elemento, "En esta clase ..." tanto para la subescala de motivación profunda (DM) (p. Ej., "A veces, estudiar me da una sensación de profunda satisfacción personal") y estrategias profundas (DS) subescala (por ejemplo, "Dedico mucho de mi tiempo libre a revisar información sobre temas y conceptos interesantes que se han cubierto"). El instrumento utiliza un formato de respuesta tipo Likert de cinco ítems que va desde “Nunca o casi nunca es cierto para mí” hasta “Siempre, o la mayoría de las veces, es cierto para mí”.

Competencia profesional percibida. En el presente estudio se utilizó la Escala de Percepción de la Competencia Profesional desarrollada por Moreno-Murcia y Silveira (2015). El propósito del instrumento es evaluar las percepciones de los estudiantes sobre la relevancia de sus conocimientos académicos para sus futuras demandas profesionales y laborales. Las respuestas se completaron en relación con la pregunta principal común de “Lo que mis instructores están enseñando me permitirá ser capaz de…” y un ítem de muestra es, “comprender la estructura, función y fases únicas de mi aprendizaje académico”. Las respuestas se proporcionan en un formato de 7 puntos que van desde "completamente en desacuerdo" hasta "completamente de acuerdo".

Competencia social. Este instrumento valora la valía percibida por el estudiante acerca de las enseñanzas que les transmiten en la Universidad y su importancia en el contexto laboral futuro (e.g. “Comprende la estructura y funcionamiento de mi campo de conocimiento, en las distintas fases del desarrollo”). La sentencia que precede los 7 ítems que componen la escala es “Lo que me están enseñando mis docentes me permite ser capaz de…”, y las respuestas varían entre 1 (totalmente en desacuerdo) a 7 (totalmente de acuerdo).

La investigación contó con la autorización del Consejo Académico y el Consejo Directivo de la Universidad de la Costa (Colombia), en el marco de la Convocatoria CONV-14-2019 y fue aprobado con el código INV.140-01-007-14. Así como la autorización de la Universidad Miguel Hernández bajo el código DPS.JMM.01.17.

En principio se hizo la socialización de la propuesta a l.a Vicerrectoría Académica, mostrando la pertinencia y relevancia de la iniciativa en función de las metas de calidad de la Institución. En las diversas instancias del estudio, se adelantó una convocatoria abierta a los profesores de los distintos programas académicos, dándoles a conocer de manera general la propuesta. Una vez definido el grupo se le informó a fondo el objetivo de la investigación y la ruta a seguir. Al igual que a los profesores, a los estudiantes se les explicó el objetivo del estudio y la forma para diligenciar los cuestionarios y se resolvieron las dudas que se presentaron. Se hizo claridad sobre el carácter voluntario de su participación, así como en el anonimato de sus identidades y respuestas; y se les invito a dar respuesta de forma honesta y sincera. Tanto con estudiantes, todos mayores de edad, como con profesores se diligenció el consentimiento informado. Para el primer objetivo, se realizaron análisis estadísticos descriptivos (medias y desviaciones típicas), se calculó la consistencia interna de los factores con el Alfa de Cronbach y correlaciones bivariadas de todas las variables del estudio. Para comprobar las relaciones existentes se empleó el método de dos pasos. En el primero (modelo de medición) se realizó un análisis factorial confirmatorio (CFA). En el segundo paso se realizó un análisis de ecuaciones estructurales para medir el poder de predicción de las variables propuestas. Los datos fueron analizados mediante los paquetes estadístico SPSS 25.0 y AMOS 24. En relación con el segundo objetivo, se realizaron análisis descriptivos en ambos grupos. También se realizaron pruebas de covarianza y se midió el efecto de la intervención. Para el tercer objetivo, al igual que para el

primero, se realizaron análisis estadísticos descriptivos (medias y desviaciones típicas), se calculó la consistencia interna de los factores con el Alfa de Cronbach y correlaciones bivariadas de todas las variables del estudio. Para comprobar las relaciones existentes se empleó el procedimiento de máxima verosimilitud junto con los métodos de bootstrapping. Los datos fueron analizados mediante los paquetes estadístico SPSS 25.0 y AMOS 24. En el cuarto objetivo, se empleó el algoritmo de *machine learning* Random Forest. El modelo de clasificación se construyó usando varios algoritmos diferentes, cada uno son sus técnicas de clasificación. Se parametrizó la configuración del funcionamiento interno del algoritmo estableciendo el valor óptimo del número de árboles a través de dos métricas: el raio de error OOB (medida sintética del nivel de precisión del modelo) (Liaw, y Wiener, 2002) y la precisión de la predicción en función del número de árboles generados. De otra parte, para evitar el desbalance en la clasificación, bien por underfitting o por overfitting, se propuso encontrar un punto medio de ajuste parametrizando y limitando el algoritmo, aplicando varias técnicas. Para generar una buena clasificación también se determinó la importancia de las variables implicadas en el modelo, empleando la medida de importancia de la característica de permutación y el Lime. Los datos fueron analizados mediante el paquete estadístico SPSS 21.0.

Resultados

Partiendo de los objetivos de la investigación se obtuvieron resultados que se recogen en los artículos ya mencionados, y que se presentan a continuación:

En relación con el primer objetivo, que se propuso comprobar la capacidad predictiva que tienen el estilo interpersonal docente de apoyo a la autonomía, y la consistencia y la perseverancia subjetiva, sobre la satisfacción de las NPB, la motivación intrínseca, la cohesión grupal y la satisfacción con la vida, en una muestra de 489 de estudiantes de educación superior. Para ello se probó un modelo que sugirió la capacidad de predicción de una alta percepción de apoyo a la autonomía del profesor y el grit, respecto a la satisfacción de las necesidades psicológicas básicas y la motivación intrínseca, y a su vez de esta última respecto a la satisfacción con la vida, siendo mediada por la cohesión grupal en estudiantes universitarios.

El segundo objetivo de investigación se propuso adelantar una intervención experimental basada en la TAD, con el fin de analizar la posible la influencia del estilo interpersonal docente de apoyo a la autonomía sobre la motivación de los estudiantes y su nivel de implicación en su proceso formativo. A partir de la intervención, se evidenció un aumento en el uso del estilo de apoyo de autonomía durante las clases de los profesores del grupo experimental, en comparación con los profesores del grupo de control, lo que tuvo como efecto que los estudiantes que recibieron mayor apoyo a la autonomía presentaron una mayor satisfacción de las necesidades psicológicas básicas y una mayor motivación. Del mismo modo, siempre que los profesores implementen un estilo de apoyo a la autonomía en sus clases sus estudiantes presentarán una mayor implicación y rendimiento.

El tercer objetivo tuvo el propósito de examinar las relaciones entre el apoyo a la autonomía del instructor para el aprendizaje de los estudiantes y las características motivacionales de los estudiantes, los procesos de estudio, las percepciones de la competencia profesional y la satisfacción con la vida. El modelo de ecuaciones estructurales obtenido reveló una relación entre el apoyo a la autonomía del instructor para el aprendizaje de los estudiantes y la satisfacción de las NPB de los estudiantes. La satisfacción de las necesidades psicológicas básicas se relacionó con la motivación intrínseca y con procesos de estudios profundo. Estos resultados permitieron ampliar la explicación de la competencia profesional percibida por los estudiantes y la satisfacción con la vida.

El cuarto objetivo se propuso determinar el mejor modelo posible capaz de predecir el éxito académico en estudiantes universitarios a partir de la satisfacción de las necesidades psicológicas básicas, la motivación académica, los procesos de estudio, y la competencia académica y social percibidas. Los resultados indicaron que el mejor modelo construido para la predicción del éxito académico se caracterizaba por una alta satisfacción de las necesidades psicológicas de competencia y relación con los demás, mayor motivación autodeterminada, un proceso de estudio profundo y mayor percepción de competencia académica y de percepción de competencia para desenvolverse socialmente de forma adaptativa.

Discusión

Los objetivos propuestos y desarrollados en el curso de la investigación, en síntesis, se recogieron en cuatro artículos que, a su vez, integran los resultados antes expuestos y generan los discusiones que, a continuación, se presentan.

En su conjunto, los artículos son complementarios. Los resultados del estudio confirman los planteamientos de la TAD que reconocen la importancia de atender en el ámbito educativo a los factores tanto contextuales como personales para promover resultados positivos.

En cuanto a los factores del contexto, la forma en la que los docentes interactúan con sus estudiantes promueve en ellos conductas positivas y adaptativas. Se confirmó que cuando ésta se caracteriza por un estilo interpersonal de apoyo a la autonomía, en contraste con el estilo controlador, aumenta la satisfacción de las necesidades psicológicas básicas de autonomía, competencia y relación con los demás, de los estudiantes (Bronson, 2016).

Con la satisfacción de las NPB, facilitada por un ambiente de aprendizaje basado en un estilo interpersonal docente de AA, los estudiantes potencian su motivación intrínseca (Bronson, 2016; Griffin, 2016). De las tres NPB, la relación con los demás presentó una mayor relación con la motivación intrínseca.

Y así como el desencadenante social en el que se constituye el profesor puede generar este efecto sobre las NPB de los estudiantes, también así sus características individuales (Fomunyam, & Mnisi, 2017). Entre ellas, se encuentra el grit, que, como factor personal, interactúa con el estilo interpersonal docente. Definido como la consistencia y la perseverancia hacia objetivos a largo plazo, describe el compromiso sostenido para terminar una tarea con

esfuerzo a pesar de las adversidades (Duckworth, Peterson, Matthews, & Kelly, 2007). Este compromiso está asociado con la capacidad de autocontrol del estudiante (González, Canning, Smyth, & MacKinnon, 2019), así como con la relación con los demás (Datu, 2017). Los hallazgos de la presente investigación ubican al grit en el mismo nivel que el estilo interpersonal de AA del profesor, como desencadenante social, en el modelo motivacional. Al igual que este último, la consistencia y la perseverancia predicen la satisfacción de las NPB y la motivación intrínseca, lo que hace de este un hallazgo particularmente llamativo y relevante.

De otra parte, la motivación intrínseca es predictora de una mayor satisfacción con la vida. Sin embargo, en los hallazgos del presente estudio, no se establece una predicción directa, sino mediada por la cohesión grupal. En este sentido, estudios sobre factores no cognitivos asociados al éxito académico en universitarios Ambrey, Ulichny, y Fleming (2017) ponen de relieve la importancia de las conexiones sociales en relación con el bienestar social. Beattie et al. (2018) y Farruggia et al. (2018) también concluyen que el sentido de pertenencia a un grupo se relaciona con el éxito académico y el bienestar personal, en el mismo sentido que lo plantean Robbins y Madrigal (2019) en relación con el desempeño y el bienestar.

En síntesis, de acuerdo con el primer objetivo, el estilo interpersonal de AA y el grit, y su poder predictivo sobre la satisfacción de las NPB y de éstas sobre la motivación intrínseca y la satisfacción con la vida (mediada por la cohesión grupal), tienen un efecto que se puede llegar a expresar en mayor logro académico y permanencia (Leenknecht et al., 2017). En general, estos resultados también coincidieron con otros estudios (Moreno-Murcia & Silveira, 2015) en el que hallaron que los estudiantes con mayor autodeterminación desarrollaban procesos de estudio profundo y están más satisfechos con la vida. En el mismo sentido, otras investigaciones han puesto de manifiesto que la motivación intrínseca se relaciona con un mayor aprendizaje, así

como con una mayor permanencia en el proceso formativo y el logro (Depasque & Tricomi, 2015; Griffin, 2016; Leenknecht et al., 2017; Orsini, Binnie, & Tricio, 2018). Y así como, en último término, el desencadenante social que representa el profesor tiene un efecto sobre el éxito académico de los estudiantes, también lo tiene el grit al situarse en su mismo nivel como predictor (Ka et al., 2019). Por su parte, la relación con los demás, al presentar una mayor relación la motivación intrínseca, da mayor coherencia al modelo por el hecho de que, a su vez la relación con los demás, correlaciona significativamente con la cohesión grupal. Esto pone de relieve la importancia de las interacciones al interior de los grupos para alcanzar la satisfacción con la vida.

Una de las limitaciones del estudio es tener un alcance correlacional. Sólo establece relaciones entre las variables tratadas y aunque el modelo de ecuaciones estructurales permite hacer una predicción, no se establece una relación de causalidad, para lo que se recomienda el desarrollo de estudios experimentales. De otra parte, aunque el modelo propuesto es el de mejor ajuste, es uno más de los posibles, a causa del problema de modelos equivalentes propio de la técnica de ecuaciones estructurales (Hershberger, 2006). Otra limitación fue haber trabajado con una muestra de estudiantes universitarios, pudiéndose ampliarla a otros niveles educativos. Por último, una implicación práctica de este estudio es considerar las variables personales del estudiante relacionadas con la autorregulación en cuanto elementos que sirvan de base para orientar las prácticas pedagógicas eficaces basadas en el fomento del apoyo a la autonomía.

El segundo objetivo se recoge en un estudio cuyos resultados confirman los efectos del estilo interpersonal de AA del profesor sobre las NPB, la motivación autónoma, la motivación controladora y la implicación, en estudiantes universitarios.

A partir de una intervención que consistió en la implementación un programa basado en la TAD en profesores universitarios, se observó en los del grupo experimental un aumento en el uso del estilo de AA durante sus clases. A partir de este encuadre del ambiente de aprendizaje, sus estudiantes, como se corrobora en otras investigaciones, presentaron mayor satisfacción de las necesidades psicológicas básicas (Cheon, & Reeve, 2015; Trigueros, Mínguez, González-Bernal, Jahou, Soto-Camara, & Aguilar-Parra, 2019; Nuñez y León, 2019), así como una mayor motivación intrínseca (Jang et al., 2016; Gillet et al., 2019), lo que confirma la importancia del contexto social sobre la satisfacción de las NPB y la motivación de los estudiantes (Sanchez-Rosas, Takaya, & Molinari, 2016). Esta mayor motivación se expresa en mayores niveles de autonomía, competencia, relación con los demás, motivación autodeterminada (Deci, Vallerand, Pelletier, & Ryan, 1991) e implicación (Hospel & Galand, 2016; Martinek et al., 2020; Reeve & Shin, 2020), coincidiendo con varios estudios.

En general, las estrategias centradas en el AA potencian la motivación autodeterminada y están asociadas a una mayor implicación en actividades académicas (Fatimawati et al., 2019) y en la competencia académica (Moreno-Murcia, Ruiz y Vera, 2015; Wang, Qiao & Chui, 2018).

En cuanto a las limitaciones, el estudio pudo haber manejado un mayor margen de tiempo en el proceso de intervención, así como haber incluido otras variables como la resiliencia y el autoconcepto.

El tercer objetivo se desarrolló a partir de un estudio que examinó las relaciones entre el apoyo a la autonomía del instructor para el aprendizaje de los estudiantes y sus características motivacionales, los procesos de estudio, las percepciones de la competencia profesional y la satisfacción con la vida, a través de un modelo de ecuaciones estructurales, que permitió, en

primer término, establecer la existencia de relaciones entre el apoyo a la autonomía del profesor y la satisfacción de las NPB de los estudiantes. A su vez, la satisfacción de las NPB se relacionó con la motivación intrínseca y con un proceso de estudio más profundo. A partir de estas relaciones se amplió la comprensión sobre la competencia profesional percibida por los estudiantes y la satisfacción con la vida, en tanto los estudiantes que cuentan con un proceso de instrucción basado en el estilo interpersonal docente de apoyo a la autonomía ven satisfechas sus NPB, incrementada su motivación intrínseca, llegando a percibirse como profesionalmente competentes en un escenario de desempeño laboral futuro, así como satisfechos con su vida.

El apoyo a la autonomía sirvió como base para la satisfacción de las necesidades psicológicas básicas y la motivación intrínseca, como se muestra en investigaciones previas (Kaplan, 2017; Núñez et al., 2015). De esta forma, facilitar escenarios de toma de decisiones y de construcción de relaciones es clave para desarrollar procesos de estudio más autorregulados y que se traduzcan en mayor éxito académico (León, Núñez, & Liew, 2015), en contraste con procesos de estudio basado en la memoria o la repetición (Doménech & Gómez, 2011). En relación con la competencia, esta satisfacción de las NPB está asociada con la satisfacción con la vida y el bienestar (Ryan & Weinstein, 2009). De otra parte, los procesos de estudio más autorregulados y profundos están asociados a una percepción más favorable de las propias competencias para un futuro laboral exitoso, como se halla en otros estudios (Ortega, 2010; Ryan & Deci, 2009), lo que se relaciona con el sentido de satisfacción con la vida (Reeve, Ryan, Deci, & Jang, 2008). De esta forma, la satisfacción de las NPB está asociada con la percepción de autoconfianza sobre el futuro ocupacional y la satisfacción con la vida (Bagoien, Halvari, &

Nesheim, 2010). Algunas limitaciones del estudio comprenden que se trató de uno transversal, por lo que no se puede suponer que existan relaciones causales entre las variables evaluadas.

El cuarto objetivo que se propuso determinar el mejor modelo posible capaz de predecir el éxito académico en estudiantes universitarios a partir de la satisfacción de las necesidades psicológicas básicas, la motivación académica, los procesos de estudio, y la competencia académica y social percibidas, determinó efectivamente que el éxito académico se caracteriza por una alta satisfacción de las NPB de competencia y relación con los demás, mayor motivación autodeterminada, procesos de estudio profundo y mayor percepción de competencia académica. De acuerdo con los hallazgos de los objetivos previos ya presentados, sugieren la satisfacción de las NPB de autonomía, competencia y relación con los demás, la motivación intrínseca y una mayor implicación dentro de los procesos de estudio (Ahmad, Vansteenkiste y Soenens, 2013) están relacionados con el estilo interpersonal docente de apoyo a la autonomía. De esta forma, los procesos de estudio, entendidos como la forma en la que los estudiantes adaptan sus estrategias de estudio para afrontar las tareas en su vida académica, involucran tanto aspectos personales como los propios de su percepción sobre la tarea (Correa, 2017). Cuando el proceso es profundo el estudiante hace mayor énfasis en su autonomía, lo que se asocia con la satisfacción de sus NPB y con su motivación intrínseca. En esa dirección, cuando se configuran estas condiciones para el éxito académico se predicen a su vez su percepción de competencia académica, respecto a sus capacidades para desarrollar con éxito una tarea y su percepción de competencia para desenvolverse socialmente de forma adaptativa (Marty, Frick, Bruderer, and Zundel, 2021). Esta percepción de sentirse capaz lo lleva a apropiarse más autónomamente de su proceso de estudio (Meng and Ma, 2015). En ese sentido, se plantea la importancia de que los profesores promuevan entornos de aprendizaje basados en el apoyo a

la autonomía (Goldman, Goodboy y Weber, 2017; Jeno, Danielsen, y Raaheim, 2018; Yu, y Levesque-Bristol, 2020).

Una limitación del estudio es que las métricas del algoritmo obtenido no resultaron aún lo suficientemente eficientes. Sería conveniente desarrollar un procedimiento con un número mayor de datos que mejore la calidad de la construcción del modelo. De otra parte, siendo un estudio transversal, es conveniente desarrollar otros longitudinales que ayuden a comprender la evolución de estas variables motivacionales en función de la titulación, el género o la edad.

Una posible implicación práctica del modelo radica en que su implementación permitiría diseñar proyectos basados en el estilo interpersonal motivacional docente y la satisfacción de las necesidades psicológicas básicas, y orientados a la prevención de la deserción en educación superior y en el logro académico de los estudiantes.

Conclusiones

En general, los hallazgos de los estudios coinciden en reconocer en el estilo interpersonal de AA un recurso pertinente y eficaz para facilitar la satisfacción de las NPB en los estudiantes universitarios, así como para potenciar su motivación intrínseca, la implicación y la motivación académica y la satisfacción con la vida. Basados en evidencias de estudios previos en escenarios afines de educación, así como en otros desarrollados en diversos grupos humanos y contextos, se puede afirmar que las intervenciones orientadas a propiciar ambientes de aprendizaje basados en el AA son clave en los contextos académicos para mejorar y mantener la implicación de los estudiantes (Fatimawati, 2019; Wang et al., 2018) y en función de éste su permanencia, persistencia y éxito académico (Green, 2018; Kahu, & Nelson 2018), así como su percepción de competencia laboral en el futuro escenario de ejercicio profesional.

Este ambiente de aprendizaje debe caracterizarse por permitir a los estudiantes la toma de decisiones entre opciones, acompañarlos y orientarlos en su proceso de estudio y por promover el trabajo en equipo a partir de relaciones cercanas entre compañeros. Todo lo anterior apoyado en un lenguaje claro y de AA (Matos, Reeve, Herrera& Claux, 2018; Cheon, & Reeve, 2015).

El modelo obtenido en el marco del primer objetivo, en particular, hace hincapié en dos elementos emergentes. De una parte, en el grit, que, al mismo nivel del desencadenante social representado en la figura del profesor que interactúa desde un estilo interpersonal de AA, predice igualmente la satisfacción de las NPB y a su vez la motivación intrínseca. Este hallazgo sugiere tener en cuenta en los encuadres en el aula, además de un ejercicio docente casado en

el AA, los factores personales, como la constancia y la perseverancia, en cuanto tienen importantes efectos sobre las NPB y la motivación. De otra parte, en la cohesión grupal, particularmente relevante en cuanto participa en la predicción de la satisfacción con la vida en función de la motivación intrínseca. Este hallazgo, además de estas asociado a la NPB de relación con los demás, subraya la importancia de la interacción en los procesos motivacionales y de bienestar personal. En esta dirección, se sugiere considerar el desarrollo de estrategias pedagógicas en el aula que promuevan el trabajo en equipo en torno a metas comunes que generen una dinámica cohesiva.

En cuanto al segundo objetivo del estudio, en el que se comprobó el efecto de la implementación de prácticas docentes basadas en el estilo interpersonal de AA, se sugiere la formación permanente de los profesores, no sólo en lo tocante a sus estudios posgraduales formales en sus disciplinas de experticia, sino una formación amplia, diversa y robusta que les permita ganar la pericia para el manejo de estrategias de enseñanza-aprendizaje (Oriol-Granado et al., 2017). Aunque la universidad de hoy privilegia al profesor desde su rol como investigador, también avanza en la ruta de reconocer y potenciar su papel como profesor formador integral. Esta práctica es respuesta a los desafíos de hoy, que ven en el desarrollo de competencias sociales un aspecto tan importante como las competencias disciplinares.

En relación con los hallazgos del tercer objetivo, éstos consolidan la idea de que el apoyo a la autonomía es clave para la motivación intrínseca y sus sucesivos efectos en el bienestar (Gutiérrez, Tomás, & Calatayud, 2017), y ponen de relieve la necesidad de que los profesores empleen estrategias pedagógicas en el aula basadas en el apoyo a la autonomía.

Un valor de los hallazgos en esta parte del estudio correspondiente al cuarto objetivo es que permiten reflexionar sobre la importancia de diseñar estrategias motivacionales docentes que pongan los intereses y preferencias del estudiante en el centro del proceso instruccional. Otro aporte valioso es que confirman los de estudios previos basados en la TAD (Nonaillada, 2019); pero desde un proceso alternativo de análisis de datos basado en el uso de random forest, constituyendo una primera aproximación respecto a estudios anteriores (Yu, and Levesque-Bristol, 2020).

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Publicaciones

Artículo 1

Lozano-Jiménez, J., Huéscar, E., y Moreno-Murcia, J. (2021). From Autonomy Support and Grit to Satisfaction With Life Through Self-Determined Motivation and Group Cohesion in Higher Education. *Frontiers in psychology*, *11*, 37-34.

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From Autonomy Support and Grit to Satisfaction With Life Through Self-Determined Motivation and Group Cohesion in Higher Education

Del apoyo a la autonomía y grit a la satisfacción con la vida a través de la motivación autodeterminada y la cohesion grupal en la educación superior

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Abstract

Using the Self-Determination Theory as a framework, this study tests the predictive capacity of the teacher's interpersonal style of autonomy support at a higher education institution, and the grit on the satisfaction of basic psychological needs, intrinsic motivation, group cohesion, and life satisfaction in university students. A sample composed of 489 Colombian university students (381 women and 108 men), aged between 18 and 41 years (M = 21.93; DT = 3.58), was used; they filled in the questionnaires that measured the variables of interest. After the analysis of structural equations, the results showed that the perception of teaching style of autonomy support and the grit positively predicted the basic psychological needs and these predicted the intrinsic motivation, which in turn predicted group cohesion and satisfaction with life. The model describes the possible importance of promoting the teacher's interpersonal style of autonomy support within the university setting in the search for satisfaction with life along with the active role of the student through the mediation of the satisfaction of basic psychological needs, increased quality motivation, and high group cohesion.

Resumen

Utilizando la Teoría de la Autodeterminación como marco, este estudio evalúa la capacidad predictiva del estilo interpersonal de apoyo a la autonomía del docente en una institución de educación superior, y el valor sobre la satisfacción de las necesidades psicológicas básicas, la motivación intrínseca, la cohesión grupal y la satisfacción con la vida. en estudiantes universitarios. Se utilizó una muestra compuesta por 489 universitarios colombianos (381 mujeres y 108 hombres), con edades entre 18 y 41 años (M = 21,93; DT = 3,58); cumplimentaron los cuestionarios que medían las variables de interés. Tras el análisis de las ecuaciones estructurales, los resultados mostraron que la percepción del estilo de enseñanza del apoyo a la autonomía y la garra predijeron positivamente las necesidades psicológicas básicas y estas predijeron la motivación intrínseca, que a su vez predijo la cohesión grupal y la satisfacción con la vida. El modelo describe la posible importancia de promover el estilo interpersonal de apoyo a la autonomía del docente dentro del ámbito universitario en la búsqueda de la satisfacción con la vida junto con el rol activo del estudiante a través de la mediación de la satisfacción de las necesidades psicológicas básicas, el aumento de la motivación de calidad y la alta cohesión grupal.

Keywords: motivation, cohesion, university students, teaching style, autonomy support

Introduction

Motivational aspects are considered important promoters of success in the educational setting (McLachlan and Hagger, 2010). The Self-Determination Theory (SDT; Ryan and Deci, 2017) has indicated that social contexts are key to generate greater well-being (Ryan and Deci,

2000). But at the same time, the SDT also explains that some personal factors play a determining role in this process along with contextual factors. In this sense, the research so far has indicated that students with higher grit scores (consistency and perseverance) tend to work more persistently (Seong-Lee and Chen-Hsieh, 2019) and achieve greater psychological well-being (Cortez et al., 2019). Furthermore, numerous adaptive outcomes such as well-being and academic success are also associated with group cohesion through building positive bonds between students (Marmarosh and Markin, 2007; Thornton et al., 2019). In this teaching scenario, the teaching role can become a powerful social trigger that promotes adaptive outcomes through certain interpersonal styles (Leenknecht et al., 2017) that, added to the existence of a grit in a student (high in grit), can enhance student motivation in dynamics that promote group cohesion as well as their perceived well-being (Bronson, 2016). Considering all of this, we attempt to go deeper into testing a new motivational model that allows understanding the relationship between these variables in higher education students.

Social and Personal Triggers

The way in which teachers interact with their students is a central component in the SDT; through their behavior, the teacher can promote positive and adaptive behaviors in their students. Autonomy support versus the controlling style is the teaching style that has demonstrated a positive impact in the academic context.

Self-Determination Theory, centered on the bright view of motivation, proposes that the style of autonomy support is a predictor of the satisfaction of the basic psychological needs (BPN) of autonomy, competence, and relationship with others (Ryan and Deci, 2000). The latter is related to the provision of social resources by people's networks, which is in line with what is

suggested by Rocchi et al. (2017). In turn, BPNs are predictors of self-determined motivation. Specifically, autonomy support is situated as a central social trigger for the development of self-determined motivation in students (Zamzami and Corinne, 2019) and as a key element for greater academic achievement and permanence (Leenknecht et al., 2017), insofar as it seeks to enhance not only autonomy and competence but also social support, understood as a relationship with others, in recognition of the key role that others play for the experience of people (Stroet et al., 2013). In the opposite sense, a controlling style that does not enhance students' BPN, including frustration in relationships, is directly related to an increase in amotivation (Martinek et al., 2020). Incorporating activities in the classroom based on providing autonomy support can lead to a better student perception of classroom instruction, giving the teacher a higher grade, improving both their motivation and learning (Griffin, 2016), and fostering greater commitment with their studies and their performance (Bronson, 2016).

The literature has highlighted the role of social triggers in satisfying basic psychological needs to promote intrinsic motivation, which in turn would be related to different effects (Haerens et al., 2015). Just as the social trigger that the teacher represents can promote quality motivation, the individual characteristics of the students also participate, and these may promote or hinder said relationship. In this sense, recent works highlight the value of taking into account non-cognitive traits in the educational setting; these non-cognitive traits, as the name indicates, do not have to do with the intellect but rather with temperamental, attitudinal, and motivational characteristics of the student (Fomunyam and Mnisi, 2017). Thus, the grit as a personal factor that the students display interacts with the interpersonal teaching style and must be taken into account. Grit is defined as consistency and perseverance toward long-term goals and describes a sustained commitment to complete a task that involves effort despite

failures, setbacks, and adversities (Duckworth et al., 2007), Therefore, it shows a strong relationship with the student's capacity for self-control (González et al., 2019). From recent literature, we know that through grit, students can enhance their own motivation, achievement, and well-being (Cortez et al., 2019; Seong-Lee and Chen-Hsieh, 2019). According to Akbağ and Ümmet (2017), grit and the satisfaction of basic psychological needs, as well as gender, are significant predictors of subjective well-being in young adults, having a positive and statistically significant relationship with each other. Specifically in a study among university students, Scherer et al. (2017) stressed the need to structure programs that develop the dispositional factors related to grit for academic success and retention. Miller-Matero et al. (2018) concluded that grit is related to academic performance, in that students who show high levels of perseverance are more likely to perform better. Borae and Kim (2017) concluded that the satisfaction of basic psychological needs is associated with grit and in turn with subjective well-being. In the same sense, Isenberg et al. (2020) conclude that grit is positively associated with personal well-being and with aspects of personality such as relationship building and empathy regarding the sense of group.

Satisfaction of Basic Psychological Needs

The SDT (Ryan and Deci, 2017) proposes as a key aspect that people have a natural desire to experience a sense of choice and psychological freedom regarding their thinking and actions. In other words, people have a tendency toward autonomous motivation and self-determination. This involves both intrinsic motivation and integrated regulation. The first, always autonomous, allows the development of an activity in an optimal and challenging way, from an internal locus of causality, and that is invigorated by basic psychological needs, without

the need for external incentives. Extrinsic motivation involves developing an activity motivated by a reward or the avoidance of punishment. However, it can become autonomous, through internalization and integration processes, which tend to occur in diverse social settings such as home and school, among others (Deci, 2004).

Although, finally, motivation rests on a continuum of processes that go from amotivation, to intrinsic motivation, through introjection, to integrated motivation (Ryan and Deci, 2020), various studies support the idea that intrinsic motivation it is highly beneficial in formal education (Taylor et al., 2014; Froiland and Worrell, 2016). Although so is integrated regulation, intrinsic motivation is a natural and inherent component of the human condition, which moves it toward action for the sake of its own psychological growth. Its mere existence allows it to be strengthened, as it is not an automatic process, and the need to seek scenarios that consolidate it is recognized, such as the condition of autonomy support by teachers. Although integrated regulation also has effects on individual well-being, and it is usual for an action to be driven by both intrinsic and integrated regulation, the latter represents an extensive route for its emergence and maintenance, directed from externality to integration.

According to various studies (Khalaila, 2014; Negovan et al., 2015; Griffin, 2016; Weidinger et al., 2016), focusing on intrinsic motivation allows starting from the natural tendency and enhancing it in a shorter way and, according to the SDT, with conditions focused on the satisfaction of the BPN (Ryan and Deci, 2020). When people have the basic psychological needs of autonomy, competence and relationship with others satisfied, self-determined motivation is promoted and, therefore, a large number of positive results are achieved (Orsini et al., 2018). In the educational context, intrinsic motivation is a key factor in the learning process (Depasque and Tricomi, 2015; Tahrekhani and Sadeghian, 2015). In particular, regarding

autonomy, the action of choosing voluntarily, in a self-determined way, promotes intrinsic motivation and greater effort in tasks (Meng and Ma, 2015). Although various studies have approached BPN in a discriminated way, others (Orsini et al., 2018; Kingsford- Smith and Evans, 2019; Li et al., 2019; Tavernier et al., 2019) have done it jointly, showing unanimity regarding positive adaptive results. To nurture students' BPNs, teachers as social triggers must adopt an interactional style that supports autonomy, which implies instructing in the possibility of choice, building learning based on the design of a clearly defined structure, and promoting relationships between students (Soenens et al., 2018). When teachers support autonomy, students have more opportunities to take initiative and play a leadership role (Vermote et al., 2020), as they catalyze greater intrinsic motivation, curiosity, and desire for challenge (Ryan and Deci, 2000), developing a more self-determined motivation and achieving the satisfaction of their basic psychological needs (Frielink et al., 2018).

Group Cohesion

Unlike the concept of relationship with others, which refers to the need for people to get involved with others and feel part of a collective through links (Ryan and Deci, 2000), group cohesion focuses on the individual sense of belonging to a group along with the moral feelings associated with the other members of the group (Bollen and Hoyle, 1990). Specifically, well-being and academic success in college students are associated with bonding and group cohesion (Marmarosh and Markin, 2007). In the same sense, Bravo et al. (2018) point out that it is key to incorporate teamwork tasks for collaborative learning in the teaching practices at the higher education level; this style of interrelation and direction in the classroom can increase individual achievement, more so than purely individual or competitive learning. In this direction Slavin

(2014) analyzes the role of social cohesion in collaborative learning, as one of the four theoretical alternatives to study performance, and points out the importance of team building and the quality of group interaction for such end.

Satisfaction With Life

Life satisfaction, understood as a cognitive component of subjective well-being, refers to the global evaluation that the person makes of their satisfaction with life (Diener, 2000). Its relationship with autonomy support in university students has been previously explored in different settings. Kim et al. (2019) found that the interaction with many other heterogeneous people through online social networks is related to both satisfaction with life on campus and with the perception of self-efficacy and personal well-being. In the same sense, Pang (2018) concludes that the intensity of the use of microblogs is positively associated with the maintenance of friendship and satisfaction with the life of the students, who by revealing their thoughts and emotions with other online users sustain friendships and achieve greater satisfaction with life. Although Moreno-Murcia et al. (2020) in a cross-cultural study concluded that perceived autonomy support is positively associated with the satisfaction of psychological needs, intrinsic motivation, and group cohesion, which suggests the promotion of positive social relationships among university students, no investigations have been found in which, added to these, grit is included as a key trigger in this process, which represents a considerable contribution of the present study.

Initial studies already indicate the importance of consolidating a solid motivational model based on SDT, to promote well-being in university students (Martín-Albo et al., 2009). Autonomy promotion strategies ensure a favorable environment for learning (Bronson, 2016). In this same sense, Leenknecht et al. (2017) state that teachers who support autonomy promote

their students' intrinsic motivation and achievement. This study focuses on testing the predictive capacity of the teacher's interpersonal style of autonomy support as well as the subjective consistency and perseverance on the satisfaction of basic psychological needs, intrinsic motivation, group cohesion, and satisfaction with life, in university students. Therefore, it is expected that the interpersonal style of autonomy support and grit positively explain the satisfaction of basic psychological needs, and these would then explain the intrinsic motivation that is expected would lead to greater satisfaction with life, mediated by group cohesion.

MATERIALS AND METHODS

Participants

The sample was made up of 489 Colombian university students (381 women and 108 men) from different levels of the Psychology Program of the Universidad de la Costa de Barranquilla (21 in 2nd semester; 47 in 3rd semester; 153 in 5th semester; 47 in 6th semester; 66 in 7th semester; 99 in 8th semester; 56 in 9th semester), with ages between 18 and 41 years (M = 21.93; DT = 3.58), and, in general, from socioeconomic strata 1 and 2 (out of 5), characterized by levels of skill development below the national average. They were selected through an intentional sampling, considering the availability of teachers at the time of administration of the instruments. Those in the first semester were not included because they were just beginning neither their training, nor those in the tenth semester because they were outside the university and advancing their professional practices.

Measurements

Autonomy Support

To measure the interpersonal style of autonomy support that the Higher Education student perceives of their teacher, the Moreno-Murcia et al. (2019) *Autonomy Support Scale* (*EAA*) was used. It consists of 12 items (e.g., "Provide explanations that help us understand the personal usefulness of carrying out this activity") and the scale begins with an introductory heading such as: "My teacher in class …". This is valued on a Likert scale from 1 (*Strongly disagree*) to 5 (*Strongly agree*). The results of confirmatory factor analysis were satisfactory: $\chi 2 = 3.87$; $p = 0.56$; $\chi 2/\text{d.f.} = 1.23$; CFI = 0.99; NFI = 0.99; TLI = 0.98; RMSR = 0.005.

Grit

The Duckworth and Quinn (2009) *Short Grit Scale*, made up of 8 items, validated in Spanish by Marentes-Castillo et al. (2019), was used. This instrument has two dimensions: consistency of interests (e.g., "I often set a goal, but then I follow another") and perseverance of effort (e.g., "Setbacks do not discourage me"). The sentence that precedes these items is "In my subject …" and the responses are valued on a five-point Likert-type scale, between 1 (*Strongly disagree*) and 5 (*Strongly agree*). The results of confirmatory factor analysis were satisfactory: $\chi 2 = 23.32$; $p = 0.00$; $\chi 2/\text{d.f.} = 3.89$; CFI = 0.90; NFI = 0.92; TLI = 0.91; RMSR = 0.05.

Basic Psychological Needs

The Spanish version of the *Échelle de Satisfaction des Besoins Psychologiques* in the educational context (León et al., 2011) of Gillet et al. (2008) was used. The scale was preceded by the statement "In my class …" and composed of 15 items referring to academic competence (e.g., "I have the feeling of doing things well"), to academic autonomy (e.g., "I generally feel free to express my opinions"), and to the relationship with other academics (e.g., "I feel good

with the people with whom I interact"). Responses were established on a Likert-type scale ranging from 1 (*Strongly disagree*) and 5 (*Strongly agree*). The results of confirmatory factor analysis were satisfactory: $\chi 2 = 94.12$; $p = 0.00$; $\chi 2/\text{d.f.} = 3.56$; CFI = 0.90; NFI = 0.90; TLI = 0.91; RMSR = 0.06.

Intrinsic Motivation

To measure student motivation, the intrinsic motivation to achievement subscale of the translated and validated version of Núñez et al. (2005) from the Échelle de Motivation en Éducation (EME; Vallerand et al., 1989) was used. The dimension is made up of four items (e.g., "For the satisfaction I feel when I excel in my studies"). It is preceded by the phrase "Why do you study this subject?" and the responses are collected on a Likert scale ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*). The results of confirmatory factor analysis were satisfactory: $\chi 2 = 21.12$; $p = 0.34$; $\chi 2/\text{d.f.} = 2.10$; CFI = 0.96; NFI = 0.96; TLI = 0.97; RMSR = 0.05.

Group Cohesion

To assess group cohesion, the group cohesion scale of Chin et al. (1999) was used. It is made up of 6 items (e.g., "I feel like I belong to this group") preceded by the phrase "In this subject, when I work in small groups …" The results of confirmatory factor analysis were satisfactory: $\chi 2 = 43.09$; $p = 0.06$; $\chi 2/\text{d.f.} = 3.92$; CFI = 0.94; NFI = 0.95; TLI = 0.93; RMSR = 0.02.

Satisfaction With Life

The *Life Satisfaction Scale* (ESDV-5) of Vallerand et al. (1989), validated in Spanish by Atienza et al. (2000, 2003) was used. It consists of five items to assess the life satisfaction factor (e.g., "I am satisfied with my life"). The previous sentence is "Satisfaction with your life…" and

the responses are collected on a Likert-type scale that ranges from 1 (*Strongly disagree*) to 7 (*Strongly agree*). The results of confirmatory factor analysis were satisfactory: $\chi 2 = 33.61$; $p = 0.12$; $\chi 2/d.f. = 2.810$; CFI = 0.97; NFI = 0.98; TLI = 0.96; RMSR = 0.03.

Process

The research was approved by the Academic Council and the Board of Directors within the framework of the CONV- 14-2019 Call and was approved with the code INV.140-01- 007-14 at the Universidad de la Costa (Colombia). After previously establishing contact with the direction of the Academic Department, the teachers involved were contacted to inform them of the research objective and request their collaboration so that the students could fill in the questionnaires during their class time. To ensure a greater number of participants, the questionnaires were administered during their regularly scheduled classes. The application was not made in the same subject, since none is repeated throughout the different semesters of the study plan. The objective of the study and how to fill in the questionnaires was explained to the students, answering any questions that could have come up during the process. In a particular way, the students were instructed to answer the questionnaires, not bearing in mind a specific subject, but rather their general experience in relation to the development of those they have taken throughout their university education. Although initially the sample consisted of 521 students, responses with outliers were presented in 32 subjects and it was decided to eliminate them. The willingness to participate and anonymity were emphasized so that the students could feel free to answer with honesty and sincerity. The time required for its completion was approximately 20 min.

Analysis of Data

Structural Equation Models (SEM) is a multivariate statistical technique for testing and estimating causal relationships from statistical data and qualitative assumptions about causality. First, descriptive statistical analyzes (mean and standard deviations) were performed, the internal consistency of each factor was calculated using the Cronbach's alpha coefficient and the bivariate correlations of all the variables under study. To check the relationship between the variables proposed in the study, the two-step method was used, as it allows testing complex relationships between variables (observed and latent) with multiple ways. The first component or step is the measurement model, focused on the relationships between theoretical constructs and their observed indicator variables, in order to attribute the unobservable latent variables of multiple observed indicator variables. These possible (hypothetical) relationships are examined in the structural model or structural equations (second component) depending on the theoretical frameworks. The estimates of the parameters are free from the incidence of measurement errors because these are taken into account in the measurement model (Wang et al., 2017). In the first step (measurement model) a confirmatory factor analysis (CFA) was performed. This analysis allowed confirming the factorial structure of the scales used in the study, as well as testing their construct validity.

To carry out the analysis of the measurement model and test the structural equation model, the number of latent variables of each of the factors that measured the different scales used was reduced, since it is advisable when the sample size is not large in comparison with the number of variables in the model (Marsh et al., 1994; Vallerand, 1997). This reduction can be done by combining the items in pairs. In this way, half of the first items of each subscale were averaged to form the first block of items and the second half was averaged to form the second

block of items, and so on down to the last factor. Once the items that make up the latent factors were divided into two random groups, a confirmatory factor analysis was performed, based on 13 observed measures (two for each of five latent constructs and three for that of the BPN and the six latent constructs that freely correlated).

The maximum likelihood estimation method and the covariance matrix between the items were used as input for the data analysis. Similarly, the contribution of each of the factors to the prediction of other variables was examined using standardized regression weights. In the second step, the structural equation model allowed to test theoretical models including all variables within the same regression model, taking more than one dependent variable, as well as considering the same variable as both dependent and independent (Klem, 1995). The model also made it possible to discover relationships that can be incorporated or suppressed for a better fit, through modification indices, which in order to be accepted met the conditions of sensibly improving the level of fit of the model and being able to theoretically justify the proposed changes (Cea, 2002). In this way, it was proposed to measure the predictive power of support for teacher autonomy, grit, basic psychological needs, intrinsic motivation on group cohesion, and satisfaction with life. A structural equation modeling procedure to test hypothesized model was conducted. The model adequacy was assessed according to the following goodness-of-fit indexes: Comparative Fit Index (CFI), Tucker- Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA) with its respective Confidence Interval (CI90%). For cutoffs, CFI and TLI ≥ 0.90, and RMSEA ≤0.80 were considered as acceptable. The Confidence Interval at 95% (CI95%) was considered to measure direct and indirect effect among constructs, accepting significance if the CI does not encompass zero. To test multi-group analysis, the structural SEM model was initially assessed in each group separately. Current

research adopted differences in CFI, TLI, and RMSEA to evaluate structural invariance. Structural invariance was considered to be acceptable when differences were ≤0.010 (Cheung and Rensvold, 2002). The data was analyzed using the statistical packages SPSS 25.0 and AMOS 24.

RESULTS

Descriptive and Correlation Analysis of All Variables

Autonomy support presented an average value of 4.11 out of 5. In the subfactors of the grit scale, consistency presented a higher mean than perseverance. Among the basic psychological needs, the mean was higher in the perceived competence sub-factor, followed by the relationship with others and autonomy. Intrinsic motivation presented a value of 6.08, group cohesion of 5.62, and satisfaction with life of 5.72. **Table 1** shows how the variables correlated positively and significantly with each other, except for perseverance with group cohesion. Regarding internal consistency, for Autonomy Support, Cronbach's alpha values of 0.86 were obtained. For grit, values of 0.73 were obtained for the subscale of persistence of interests and of 0.80 for the subscale of perseverance of effort. For Basic Psychological Needs, internal consistency was 0.88 for competence, 0.84 for autonomy, and 0.87 for relationship with others, and jointly 0.93. For intrinsic motivation, a Cronbach's alpha of 0.79 was obtained. For group cohesion, a value of 0.95 was obtained. Finally, for satisfaction with life, a Cronbach's alpha of 0.90 was obtained.

Table 1. Mean, standard deviation and correlations between variables.

	M	*DT*	α	1	2	3	4	5	6	7	8	9
1. Autonomy support	4.11	.59	.86	-	.31**	.15**	.22**	.33**	.34**	.33**	.22**	.22**
2. Consistency	4.04	.75	.73	-	-	.30**	.31**	.32**	.29**	.25**	.26**	.35**
3. Perseverance	3.45	1.00	.80	-	-	-	.10**	.14**	.16**	.11**	.07	.14**
4. Autonomy	4.05	.77	.78	-	-	-	-	.62**	.55**	.20**	.35**	.40**
5. Relationship with others	4.31	.66	.85	-	-	-	-	-	.69**	.36**	.56**	.47**
6. Competence	4.46	.57	.82	-	-	-	-	-	-	.35**	.36**	.38**
7. Intrinsic motivation	6.08	1.04	.79	-	-	-	-	-	-	-	.41**	.38**
8. Group cohesion	5.62	1.30	.95	-	-	-	-	-	-	-	-	.54**
9. Satisfaction with life	5.72	1.18	.87	-	-	-	-	-	-	-	-	-

Measurement Model

To analyze the relationships and interactions between the variables of the model that is proposed (autonomy support, consistency and perseverance, basic psychological needs, intrinsic motivation, group cohesion and satisfaction with life), the structural equation model was used. A series of indices were taken into account [$\chi 2$, $\chi 2$/d.f. = l, CFI (comparative fit index), NFI (normed fit index), TLI (Tucker Lewis index) and RMSEA (root mean square error of approximation)]. All the variables showed skewness and kurtosis values of <|2| and <|7|, respectively. On the other hand, Mardia's multivariate index was found above 70, so it can be inferred that there was no multivariate normality (Rodríguez and Ruiz, 2008). The maximum likelihood estimation method and the covariance matrix between the items were used as input for data analysis. The indices obtained after the analysis were $\chi 2 = 260.79$; $p = 0.00$; $\chi 2$/d.f. = 4.49; NFI = 0.90; CFI = 0.92; TLI = 0.90; RMSEA = 0.08. These data adjust to the established parameters, so the proposed model can be accepted as good (Hu and Bentler, 1999). Similarly,

the contribution of each of the factors to the prediction of other variables was examined using standardized regression weights. These weights range from 0.48 to 0.81. The t value associated with each weight was taken as a measure of contribution, so that values greater than 1.96 are considered significant.

Structural Regression Model

The indices obtained after the analysis presented an adequate adjustment model (**Figure 1**): $\chi 2 = 124.56$; $p = 0.00$; $\chi 2/\text{d.f.} = 2.49$; NFI = 0.90; CFI = 0.95; TLI = 0.95; RMSEA = 0.05.

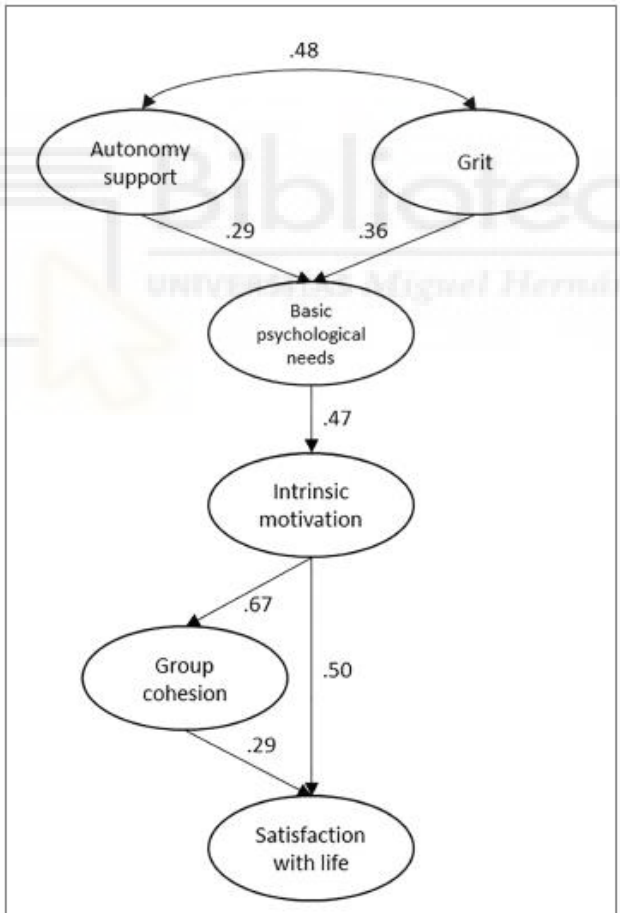

FIGURE 1 | Structural equation model. The parameters are significant at $p < 0.05$ and standardized.

Analysis of Measurement Invariance by Sex and Age Groups

In the analysis of invariance across sex, the objective was to establish whether the structure of the confirmatory factor analysis was invariant in two independent subsamples, one of men and the other of women, by means of a multigroup analysis. The results as shown in **Tables 2** and **3** showed that the four models compared had good fit indices. The differences found between the unrestricted model (model 1) and the model with invariance in factorial weights (model 2) were not significant ($\chi 2 = 14.05$, $df = 7$, $p = 0.10$). Regarding age, the entire sample was grouped into two groups (18–20 years and +20 years), after the analysis, the differences found between the model without restrictions (model 1) and the model with invariance in the weights factorials (model 2) were not significant ($\chi 2 = 8.5705$, $df = 6$, $p = 0.10$). This allows establishing a minimum acceptable criterion to consider the existence of invariance in the measurement model with respect to sex and age groups (Byrne et al., 1989; Marsh, 1993).

TABLE 2 | Multigroup analysis of invariance of the model by sex.

Models	χ^2	*g.l.*	χ^2/*g.l.*	$\Delta\chi^2$	Δ*g.l.*	CFI	IFI	RMSEA
Model 1	31.17	18	1.73	-	-	0.91	0.91	0.06 [0.056, 0.072]
Model 2	14.05	7	2.01	8.14	5	0.91	0.91	0.06 [0.056, 0.071]
Model 3	10.51	6	1.75	23.23	6	0.91	0.91	0.06 [0.055, 0.070]
Model 4	55.64	16	3.47	32.85*	12	0.90	0.90	0.06 [0.056, 0.072]

*Model 1 = no restrictions; Model 2 = invariant measurement weights; Model 3 = invariant structural covariances; Model 4 = invariant measurement residuals. *p < 0.05.*

TABLE 3 | Multigroup analysis of invariance of the model by age.

Models	χ^2	*g.l.*	χ^2/*g.l.*	$\Delta\chi^2$	Δ*g.l.*	CFI	IFI	RMSEA [90% CI]
Model 1	23.32	18	1.29	-	-	0.91	0.91	0.06 [0.055, 0.071]
Model 2	8.57	6	1.22	9.43	5	0.91	0.91	0.06 [0.055, 0.070]
Model 3	14.63	9	1.62	17.76	6	0.91	0.91	0.06 [0.054, 0.072]
Model 4	42.42	13	3.26	28.15*	9	0.90	0.90	0.06 [0.056, 0.072]

*Model 1 = no restrictions; Model 2 = invariant measurement weights; Model 3 = invariant structural covariances; Model 4 = invariant measurement residuals. *p < 0.05.*

DISCUSSION

This study tested a model that emphasized the predictive capacity of a high perception of teacher's autonomy support and student grit to improve life satisfaction in university students, being mediated by the satisfaction of basic psychological needs, intrinsic motivation, and group cohesion. The results confirmed the hypothesis. Furthermore, all variables were positively and significantly correlated with each other, except perseverance with group cohesion. It is confirmed that the interpersonal style of autonomy support, as well as the grit, both as triggers in the motivational process, positively predict basic psychological needs and intrinsic motivation, and the latter predicts group cohesion and satisfaction with life.

Of the three basic psychological needs, it is the relationship with others that presented the greatest correlation with intrinsic motivation, which is consistent with the fact that, in turn, the relationship with others correlated significantly with group cohesion. This highlights the importance of the relationships within the groups for life satisfaction. Corroborating this statement from previous research, Datu (2017) points out that the sense of relationship with others (teachers and parents) is linked to a higher value in societies where proximity in relationship prevails over individualism, and it is associated with greater consistency and perseverance.

In general, these results also coincided with other studies (Moreno-Murcia and Silveira, 2015) in which they found that students with greater self-determination developed deep study processes and were more satisfied with life. In this same sense, Clark and Malecki (2019) found consistent and positive associations between academic determination and academic performance, life satisfaction and school satisfaction, although in a group of high school adolescents. Along the same line, other investigations have shown that intrinsic motivation is

related to greater learning, as well as greater permanence in the training process and achievement (Depasque and Tricomi, 2015; Griffin, 2016; Leenknecht et al., 2017; Orsini et al., 2018).

The evidence obtained from this research places grit as a social trigger in the motivational model. It is striking that both dimensions, consistency and perseverance, also predict basic psychological needs and intrinsic motivation, as this predictive relationship is usually related to the teacher's interpersonal style. In this same direction, Ka and Zhoun (2019) and Tynan et al. (2020) also place them at the same level as a predictor of academic success.

Similarly, additional evidence from this study showed that group cohesion mediates with satisfaction with life, in the same way that Robbins and Madrigal (2019) in relation to performance and well-being. Also, Ambrey et al. (2017) highlight the importance of social connections in relation to social well-being. Likewise Beattie et al. (2018) and Farruggia et al. (2018) conclude in their studies on non-cognitive factors associated with academic success in university students, that the academic mentality, in relation to the sense of belonging to a reference group, is related to academic success.

Therefore, the results of this study highlight SDT's postulates regarding the importance of taking into account both contextual and personal factors in the educational field to promote positive results. In this sense, we think that the teacher could take into account that this will be possible to achieve when interaction with their students is perceived with high autonomy support, but also when consistency and perseverance are high. Our recommendation, based on the evidence from this work: it would be advisable for the teacher to focus, especially within their style of autonomy support, on those strategies that foster a committed interest in the task

along with the teacher's sustained accompaniment over time and always focused on a realistic goal. With this and given the existing correlation with group cohesion that is fueled by the psychological need for a relationship with others in which the student feels a connection with others, the teacher will be able to contribute to increasing the well-being of the student.

The present study contributes to the literature insofar as it assesses the mediating effect of screaming, in relation to autonomy support, BPN, group cohesion, and satisfaction with life. The study confirmed previous findings in the sense that teachers have a decisive influence on satisfaction of BPN, intrinsic motivation, and satisfaction with life, and thus, highlights the need to create student-friendly climates. But also, in a similar way, it showed that grit also plays an important role in this process and, therefore, the urgency for teachers to become facilitators to enhance in their students a sense of consistency and perseverance, as well as a greater sense of group cohesion in their active participation in learning scenarios.

One of the limitations of the study is that, having a correlational scope, only correlations are established between the variables treated, and although the structural equation model allows a prediction to be made, it is not possible to establish a causal relationship. Experimental studies that explain the causal relationships of the studied variables, and others in which the sample is randomized and equally distributed by gender, are necessary. In addition to the issue of scope, the type of cross-sectional design adopted does not allow an analysis to be advanced in a longer timeline. This makes it necessary for subsequent studies to measure the evolution of the variables in various temporal cuts. Furthermore, the proposed model is the one that presented the best fit, but due to the problem of equivalent models presented by the technique of structural equations (Hershberger, 2006), it is assumed that the proposed model would be only one of the possible ones. Another limitation is that the study was developed from a brilliant

motivational process model and did not take into account the dark path posed by the dual process, thus it could not have considered other possible explanations around the impact of both social and personal factors in relation to with satisfaction with life. A final limitation has to do with the selected sample, since it was only about university students. Future studies may consider other educational levels such as primary or secondary education.

In conclusion, both the interpersonal style of autonomy support and the grit, as well as the establishment of solid interpersonal relationships, are key factors associated with the satisfaction of basic psychological needs, motivation, and well-being. As practical implications, in a higher education setting, the consideration of certain personal student variables related to self-regulation should be elements that serve as a basis to complement and guide effective pedagogical practices based on promoting autonomy support and strengthening the processes of permanence and success of students. From this, teachers have the opportunity to enhance student motivation through pedagogical strategies that promote group cohesion (Bronson, 2016). This represents a challenge, since according to Ryan and Deci (2020) conventional relationship styles are installed under the protection of institutional models and educational policies conventionally centered on control practices.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Academic Council and the Board of Directors within the framework of the CONV-14-2019 Call, and were

approved with the code INV.140-01-007-14 at the Universidad de la Costa (Colombia). The patients/ participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JL-J advanced the relationship process with the University to have the guarantees to carry out the study, as well as the contact with the professors and the management of the informed consent of the students. In that same sense, the administration process of the surveys and their initial tabulation. JM-M and EH led the data processing and analysis process, with the support of JL-J. Finally, all authors structured the final version of the manuscript after exhaustive reviews of documents relevant to the research.

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Artículo 2

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Effects of an Autonomy Support Intervention on the Involvement of Higher Education Students

Efectos de una intervención de apoyo a la autonomía en la implicación de estudiantes de educación superior

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Abstract

Intervention studies based on Self-Determination Theory (SDT) in educational contexts prove the importance of the teacher's motivating interpersonal style, promoting positive results in students' motivation. However, college practices and processes have new challenges. This study examines the repercussions of an intervention program with autonomy support on students' involvement. The sample was randomly divided into two groups, an intervention group composed of 12 teachers, aged between 25 and 56 years (M = 35.38; SD = 7.71) and 113 students, aged between 18 and 28 years (M = 20.53; SD = 2.42); and a control group consisting of 12 teachers, aged between 25 and 44 years (M = 35.11; SD = 5.79), 107 students, aged between 18 and 39 years (M = 21; SD = 3.68). Quantitative and qualitative data were collected on the motivating interpersonal style, satisfaction of basic psychological needs, academic motivation and student involvement. The results demonstrate in general the effectiveness of the intervention on the perception of autonomy support to improve student involvement; this relationship is mediated by the improvement of psychological needs and academic motivation. The results are discussed around the recommendation of motivational strategies that the higher education teacher should implement to promote students' involvement.

Keywords: self-determined motivation; basic psychological needs; interpersonal style; university students

Resumen

Los estudios de intervención basados en la Teoría de la Autodeterminación (TAD) en contextos educativos demuestran la importancia del estilo interpersonal motivador del docente, promoviendo resultados positivos en la motivación de los estudiantes. Sin embargo, las prácticas y los procesos universitarios tienen nuevos desafíos. Este estudio examina las repercusiones de un programa de intervención con apoyo a la autonomía en la participación de los estudiantes. La muestra se dividió aleatoriamente en dos grupos, un grupo de intervención compuesto por 12 docentes, con edades entre 25 y 56 años (M = 35.38; DT = 7.71) y 113 estudiantes, con edades entre 18 y 28 años (M = 20.53; DT = 2.42); y un grupo control formado por 12 docentes, con edades entre 25 y 44 años (M = 35.11; DT = 5.79), 107 estudiantes, con edades entre 18 y 39 años (M = 21; DT = 3.68). Se recolectaron datos cuantitativos y cualitativos sobre el estilo interpersonal motivador, la satisfacción de las necesidades psicológicas básicas, la motivación académica y la participación de los estudiantes. Los resultados demuestran en general la efectividad de la intervención sobre la percepción de apoyo a la autonomía para mejorar la participación de los estudiantes; esta relación está mediada por la mejora de las necesidades psicológicas y la motivación académica. Los resultados se discuten en torno a la recomendación de estrategias motivacionales que el docente de educación superior debe implementar para promover la participación de los estudiantes.

Introduction

Globally, most countries are actively advancing in response to the transformational demand that the higher education context has been facing for the last two decades [1,2], with the goal of improving the quality of academic processes and achieving high-quality accreditation [3]. Therefore,

the transformation of higher education institutions (HEIs) is recognized as the epicenter of innovation, technology and human capital, which have been expressed in the transmission of applied knowledge within the framework of interaction processes with the external sector [4], which facing the challenges of the global economic context, requires both academic excellence and the development of positive psychological capacities and the search for competitive advantages [5]. In this process, dropout and student academic performance, as basic conditions for quality [6], are two key aspects to consider in the approach to understanding the personal and social variables involved in the motivational processes that determine the student's involvement. In this scenario, the Self-Determination Theory (SDT, [7]) is an inescapable frame of reference [8]. The SDT points out that a teacher's motivating interpersonal style practices oriented at promoting intrinsic motivation should focus on satisfying the basic psychological needs of autonomy, competence and relationships with others [9], which call for results, such as academic involvement of students [10–12] and their motivation to learn, regularly attend classes and participate in academic activities [13]. Therefore, the need arises from universities and teachers themselves to find useful tools to provoke positive changes in the students' attitudes towards their academic training. Based on the evidence that shows the benefits they have on motivation and academic involvement, and ultimately the quality and academic success, the implementation of teacher's motivating interpersonal style focused on the mobilization of the student's internal resources is significant [14].

Importance of the Teacher's Motivating Interpersonal Style

The SDT's purpose is to understand the volitional nature of behavior through the influences of context triggers, as well as the result of the perceptions that the person makes about that influence [15]. Thus, it suggests that there are three basic psychological needs related to motivation: autonomy, which involves volitional aspects and the organization of behavior based on activities

consistent with the integrated sense of self, in which individuals feel they can choose and have some control over the consequences; competence, which refers to the individual's perception of feeling capable and effective when performing her tasks; and the relationship with others, which refers to the need for people to get involved with others in a meaningful way and feel part of a group or a collective in general through the establishment of links [7]. According to the SDT, the teacher's motivating interpersonal style is understood as the form of interpersonal behavior that the teacher manifests during interaction with his students [16]. The motivational style can have a decisive influence on the results that students have in class. The motivational style is composed of a series of interpersonal relational skills, ranging from a controlling range to a range of autonomy support. Regarding teachers who promote autonomy support, this style is made up of the following aspects: 1. Provision of choice, 2. Structure and 3. Empathy in the perspective of positive affect in the relationship with others. However, the controlling style is associated with the teacher imposing his own rules on the students and using threats or pressure as frequent behavior with his students. The teacher's motivating interpersonal style can influence students' motivation, ranging from one that is more supportive or one that is more frustrating for their basic psychological needs. When these are satisfied, students report more motivation and involvement [17,18] and are more likely to deeply process the learning material, producing better performance [19], greater well-being [20], higher educational aspirations, persistence in educational pathways and lower levels of academic dropout [21]. That is, when teachers support the preferences of students in the pursuit of their personal interests and goals, they become more and better engaged in their learning process [22].

On the contrary, a controlling style, based on pressure and threats, can lead to action motivated solely by the fear provoked by punishment [23], which is associated with lack of involvement [19], loss of initiative and less learning [7].

This way, teachers become one of the main responsible for promoting satisfactory experiences in the classroom, as their work is decisive for the motivation of students [24].

Recent studies, such as those by Behzadniaac, Adachic, Deci, and Mohammadzadeha [25], Goldman, Goodboy, and Weber [26], Jeno, Danielsen, and Raaheim [27], and Yu & Levesque-Bristol [28], coincide in pointing out the importance of self-determined motivation as a key element for academic performance and learning. Previous research, based on the SDT, such as those referenced, has found that autonomy support is associated with positive results such as well-being and autonomous motivation. In particular, it has shown that teachers who use an autonomy support style through the promotion of psychological needs achieve greater engagement in their students. However, the controlling style, characterized in that the teacher imposes their own way of thinking, feeling and acting, has been associated with negative student performance expressed in poor academic performance. Conversely, the autonomy support style takes into account the perspective of the students, their preferences and interests. In the controlling style, even the language itself is characterized by imposing expressions, such as “got to,” “must” or “have to,” lacking sense and argument that supports the desired behaviors. Correlational studies have seen the importance of addressing autonomy support. Additionally, in observational studies [29], autonomy support has been evaluated in terms of rank typology through frequency scores, with qualitative scores taken from extracts of classes recorded on video [30,31]. However, qualitatively based observational studies are not common. Based on this analysis, it can be considered that the success or failure in the academic experience of the students is subject to the teacher’s motivating interpersonal style in the processes in higher education, which will highlight the self-determined motivation of the students and their academic involvement [22].

Teacher's Motivating Interpersonal Style and Student Involvement

According to the SDT, involvement is a reflection of the positive development of an individual and is a key element for retention, persistence [32,33] and academic success [15]. In this sense, the teacher's motivating interpersonal style of autonomy support, by satisfying the basic psychological needs of students, contributes to improving academic involvement, defined as the level of effort that students dedicate to their learning, and that brings positive consequences, such as performance and well-being. It also states that involvement is a state influenced by contextual factors [34]. This way, autonomy support practices are associated with greater academic involvement [10], as they have a significant positive impact on the regulation of autonomous learning. Perceiving autonomy seems to be an important predictor of academic involvement [35], although structure, related to the sense of competence, is also another key element for it. However, while autonomy refers to the degree of freedom that teachers allow their students to self-determine in the development of classes, structure refers to the clarity and quantity of information provided to students regarding how to achieve the objectives proposed in the classroom [14,34].

Recently, Xu, Chen, and Chen [36] analyzed various studies and proposed that involvement can be behavioral, cognitive or emotional and that in any case, this is a key factor for academic success, predicted by the satisfaction of basic psychological needs through the provision autonomy support and structure in the classroom.

The Present Study

Aware of the importance of the role of the teacher in the academic success of students in higher education [37] and its impact on the academic involvement assumed by students [38], the present study set out to examine the influence of an intervention based on the teacher's motivating interpersonal style of autonomy support on the involvement of the student through the

motivational process suggested by the SDT regarding the analysis of the role of psychological needs and the student's academic motivation. The study tested three hypotheses. First, we proposed: (1) Students in the intervention group with autonomy support, compared with students in the control group, would report a longitudinal improvement in the satisfaction of their academic basic psychological needs. Hypothesis (2) was proposed that the students in the intervention group, in comparison with those in the control group, would report an improvement in autonomous motivation. Finally, hypothesis (3): The students in the intervention group, compared to the students in the control group, would report a longitudinal improvement in their academic involvement after the intervention.

Materials and Methods

Participants

The sample was made up of 220 Colombian university students (144 girls and 76 boys) of different levels of undergraduate academic programs in engineering, psychology, bachelor of education, law, social communication and architecture, at the Universidad de la Costa de Barranquilla, a private higher education institution, (37 in 3rd level; 22 in 4th level; 62 in 5th level; 29 in 6th level; 38 in 7th level; 13 in 8th level; 18 in 9th level). Their ages ranged between 18 and 39 years (M = 20.76; SD = 3.10). The participants were intentionally divided into an intervention group (n = 113), consisting of 59 men and 54 women, and a control group (n = 107), with 17 men and 90 women. Twenty-four university professors responsible for the study students (11 men and 13 women) of different levels and undergraduate academic programs from the same university, aged between 25 and 56 years (M = 34.83; SD = 7.55) also participated. The professors were intentionally divided into an intervention group, which would be trained to teach their classes with a style of autonomy support (n = 12), made up of 5 men and 7 women, and a control group, which would use

the model traditional class (n = 12), made up of 6 men and 6 women. To make up the intervention group, those professors who presented themselves to an open invitation to be part of a training course offered by the university were selected. The control group was made up of teachers who were invited to be part of an investigative process as a control group. The students participating in the study corresponded to those who had subjects enrolled in the semester in the courses of the teachers of both groups. In parallel, qualitative data were also collected and analyzed to complement and go into detail about the study of the variables contemplated in this research. After being informed of the objectives of the research, that the process would imply the completion of surveys at various times, and the recording of the classes on video, all the participants gave their consent. The selected sample ensured that the participants were from various semesters and academic programs.

Measurements

Autonomy support. To measure the motivating interpersonal style of autonomy support that the Higher Education student perceives from his teacher, the Scale of Autonomy Support by Moreno-Murcia et al. [39] was used. It consists of 12 items (e.g., “Provide explanations that help us understand the personal utility of carrying out this activity”), and the scale begins with an introductory heading such as: “My teacher in class ...”. This is valued on a Likert scale from 1 (Totally disagree) to 5 (Totally agree). Internal consistency for take one was 0.92, and for take two, it was 0.93. This scale has shown reliability rates higher than 0.70 in previous works.

Controller style. To measure the controlling interpersonal style that the Higher Education student perceives from their teacher, the Controlling Style Measurement Scale by Moreno-Murcia et al. was used. [40]. It consists of 12 items (e.g., “It gives very few guidelines and no alternatives on how to carry out the tasks it presents”), and the scale begins with an introductory heading such as:

"My teacher in class ...". This is valued on a Likert scale from 1 (Totally disagree) to 5 (Totally agree). Internal consistency for take one was 0.91, and for take two, it was 0.94. This scale has shown reliability rates higher than 0.70 in previous works.

Academic motivation. To measure student motivation, the version translated and validated into Spanish by Núñez et al. [41] of the Échelle de Motivation en Éducation (EME) (Vallerand et al., 1989) was used. It is preceded by the phrase "In this subject," and the responses are collected on a Likert-type scale that ranges from 1 (Totally disagree) to 5 (Totally agree). The internal consistency for the dimensions in take one: intrinsic motivation to knowledge (MIC) was 0.83; intrinsic motivation to achieve (MIL) was 0.78; intrinsic motivation to experience stimulation (MIEE) was 0.70; identified extrinsic motivation (MEI) was 0.72; introjected extrinsic motivation (MEIN) was 0.76; external regulation extrinsic motivation (MERE) was 0.77; demotivation (DESMOT) was 0.88. The internal consistency for the dimensions in take two: intrinsic motivation to knowledge (MIC) was 0.86; intrinsic motivation to achieve (MIL) was 0.87; intrinsic motivation to experience stimulation (MIEE) was 0.72 identified extrinsic motivation (MEI) was 0.87; introjected extrinsic motivation (MEIN) was 0.72; external regulation extrinsic motivation (MERE) was 0.69; demotivation (DESMOT) was 0.90. This scale has shown reliability rates higher than 0.70 in previous works.

Basic psychological needs. The Spanish version of the Échelle de Satisfaction des Besoins Psychologiques was used in the educational context [42] by Gillet et al. (2018). The scale was preceded by the statement "In my class ..." and composed of 15 items referring to academic competence (e.g., "I have the feeling of doing things well"), academic autonomy (e.g., "I generally feel free to express my opinions"), and to the academic relationship with others (e.g., "I feel good with the people with whom I interact"). The answers were established on a Likert-type scale that ranged from 1 (Does not correspond at all) and 7 (It corresponds totally). The internal consistency

for the dimensions in taking one for autonomy was 0.75, for competence was 0.84, and for the relationship with the others, it was 0.82. On the other hand, the internal consistency for the dimensions in take two for autonomy was 0.77, for competence was 0.89, and for the relationship with the others, it was 0.90. This scale has shown reliability rates higher than 0.70 in previous works.

Implication. To assess the implication, the scale of Núñez and León [43] was used. It is made up of 12 items, which are scored on a Likert scale from 1 (Totally disagree) to 7 (Totally agree). Internal consistency for take one was 0.91, and for take two, it was 0.94. This scale has shown reliability rates higher than 0.70 in previous works.

Verification of the intervention. To assess the effectiveness of the intervention treatment, videotaped lectures were observed and analyzed by two expert evaluators in interventions with autonomy support. To do this, the Barrachina, Huéscar, and Moreno-Murcia [44] scale of observation of behaviors in support of autonomy was used, consisting of 4 categories and 25 subcategories, organized into 35 questions with a yes or no answer. The first and second categories had 5 subcategories and 5 questions each. The third category had 8 subcategories and 13 questions. The fourth category had 7 subcategories and 12 questions. The results obtained by rater 1 were used in the data analysis, while those from rater 2 were used to estimate inter-rater reliability. The internal consistency of the dimensions was 0.82, 0.91, 0.90 and 0.92, respectively, and the inter-rater reliability was 0.84.

Fidelity of the intervention. To assess the fidelity of the intervention, semi-structured interviews were carried out with only the teachers of the intervention group, as some studies have already carried out in advance [19,45]. The interview dealt with topics related to teacher satisfaction with the autonomy support instruction. A series of questions was carried out through focus groups: How

would you define the role you have within the learning process of the students, your role? Did you have the opportunity to perceive that students expressed their perception regarding their teacher's motivating interpersonal style practices in the classroom? What did losing control and allowing the student to have it and be more self-determined mean to you? How did you experience this process? How do you think you are perceived by your students? How has it been the experience of feeling capable and facilitating students to also perceive themselves as competent and capable? In that process of perceiving yourself as capable of appropriating the tools, did you have any obstacles? How did they deal with them? How or in what way did they show that the students were transforming their way of being and being in class? How did you feel about the way of expressing yourself in the classes, going from being directive to more open? Speaking of motivation, what can we say about what motivates us in our work as teachers, as facilitators, as companions? Is the task of being a teacher worth it?

Process

This research was approved by the Academic Council and the Board of Directors of the main researcher's university within the framework of the CONV-14-2019 Call and was approved with the code INV.140-01-007-14 at the Universidad de la Costa (Colombia).

The procedural schedule for the implementation of the intervention is shown in Figure 1. The academic year in Colombia consists of 2 semesters per year (16 weeks in each semester, approximately 4 months). The present study was carried out during the second semester of the academic year through quantitative and qualitative measurements and analysis. At time 1 (week 4 of the 2nd semester), students completed the questionnaire package. Their responses were ensured confidential and used for research purposes only.

When the first data collection was completed, the teachers in the intervention group conducted training based on the trained autonomy support strategies, as shown in Figure 2, while the teachers in the control group taught their classes using their existing instructional objectives ("Teach as usual"). The intervention was carried out with twelve teachers and their groups of students in different subjects, between March and May 2019, in a total of one hundred and forty-four classes of 120 min, once a week, distributed over twelve weeks. At time 2 (week 14 of the semester), students completed the study questionnaire a second time. At the end of the semester, individual semi-structured interviews were carried out with the teaching staff and the students of the intervention group. The content of the interviews was based on the results of the literature review that suggested key areas in supporting autonomy.

Figure 1. Procedural timeline for intervention with autonomy support and moments of data collection (T1 = Time 1; T2 = Time 2).

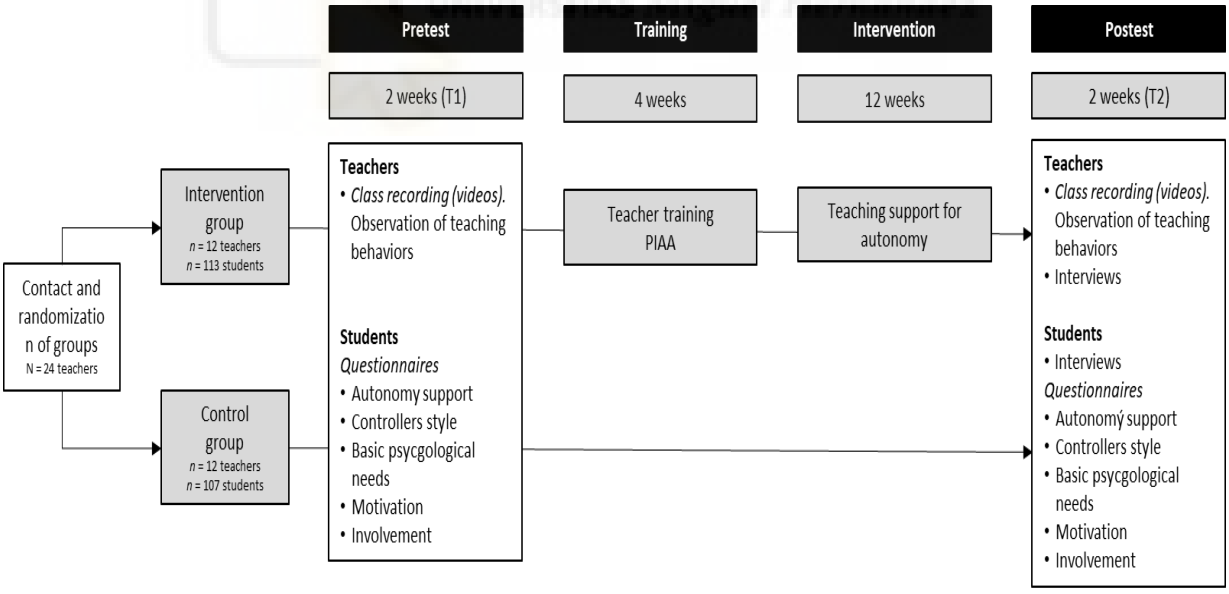
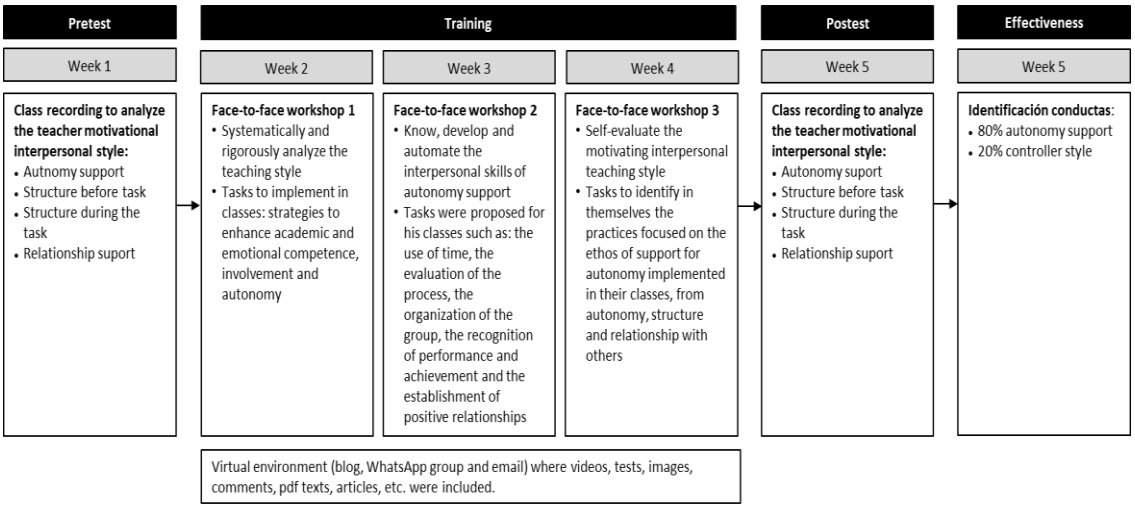


Figure 2. Training process in the Intervention Program with Autonomy Support.



They sought a detailed exploration of individual experiences and the meanings that these had for them [46].

To evaluate and control the effectiveness of the intervention, three classes of each teacher were filmed, between March and June, one before starting the intervention, another at the end of the training and a third at the end of the academic period. Two evaluators observed 10/15 min of a class period of each teacher in three moments (beginning, middle and end) of the semester.

Before implementing the study, the teachers of the intervention group voluntarily participated in a training workshop on autonomy support. In this workshop, participants were taught the concepts of motivation advocated in the SDT [47] and instructional behaviors to facilitate higher levels of autonomy support and reduce controlling style behaviors during classes [48–50]. Teachers completed the workshop, and measurements were made in a pilot study of four classes with students that had nothing to do with the present study. The purpose of the pilot study was to help teachers and ensure the correct application of each approach (autonomy support and control), and thus, achieve intra-observer reliability that was higher than 90%.

Descriptive analyses were executed to evaluate the teacher's interactions during classes, using the scale of measurement for the interpersonal style of Barrachina et al. [44]. According to

some studies [51], which took similar measures, 80% or more of the interactions recorded using the teacher's interpersonal style should be directed to the autonomy of the intervention group. On the other hand, in the control group, 80% of the interactions must be characterized by the control style. In the present study, both groups obtained indices within those reported in the literature, as shown in Table 1.

Table 1. Frequency and percentage of interpersonal styles by group.

	Moment 1				Moment 2				Moment 3			
	Interv. group		Control Group		Interv. group		Control Group		Interv. group		Control Group	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Autonomy suport	240	80%	48	16%	245	81%	45	15%	255	85%	36	12%
Controller style	60	20%	225	75%	55	19%	230	77%	45	15%	237	79%
Neutral style	0	0%	27	9%	0	0%	25	8%	0	0%	27	9%
Total	300	100%	300	100%	300	100%	300	100%	300	100%	300	100 %

<To avoid discrepancies between the study hypotheses and the practical reality, the students' perception of the interpersonal style used by the teacher (autonomy or control) was also measured. The objective was to obtain the students' perspective on the effects of the intervention. After performing the covariance tests, the effect of the intervention on perceived autonomy support was measured using the Autonomy Support Scale (ASS) and the Control Style Scale (CSS) (Figures 3 and 4). After the intervention, it was found that in the intervention group there were differences in autonomy support (M T1 = 4.19 and M T2 = 4.49; $p < 0.001$; F (1112) = 22.65; $d = 0.16$), and in the controlling style (M T1 = 2.84 and M T2 = 1.97; $p < 0.001$, F (1112) = 44.08; $d = 0.28$), with an increase in autonomy support and a decrease in the controlling style. In the control group, differences were observed in autonomy support (M T1 = 4.48 and M T2 = 3.61; $p < 0.001$; F (1106) = 85.63; $d = 0.45$), and in the controlling style (M T1 = 2.29 and M T2 = 2.04; $p < 0.01$; F (1106) = 6.11; $d = 0.05$), decreasing the two measures after the intervention.

Figure 3. Students' perception of the teacher's motivating interpersonal style of autonomy support.

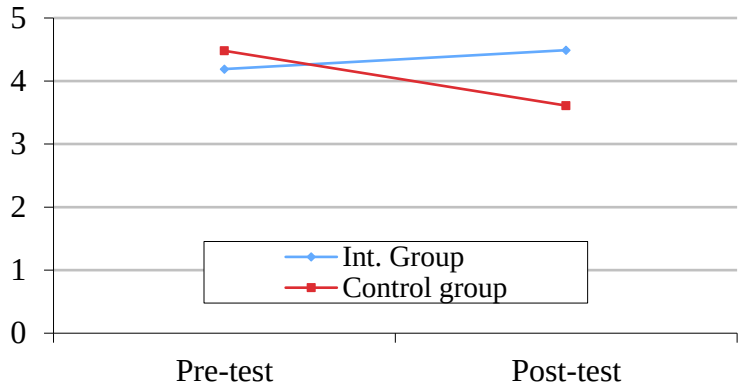
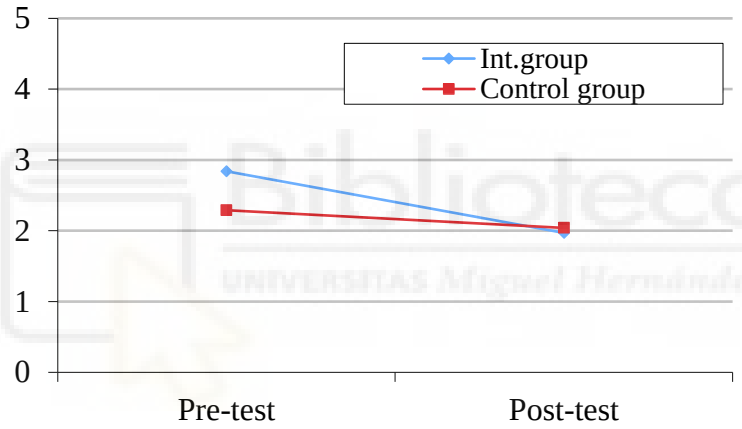


Figure 4. Students' perception of the teacher's controlling style.



Statistical Analysis

To analyze whether there were any differences between the control group and the experimental group in the study's target variables before the intervention, a Levene test was performed with the pretest variables of the groups. To answer the research questions, a repeated-measures analysis of variance (ANOVA) was performed. Attending to Cohen, 1988, the effect size was calculated using his cut-off values for small 0–0.2, medium 0.2–0.5 or large 0.5–0.8. The internal consistency of each factor was analyzed using Cronbach's alpha coefficient. The data were analyzed using the SPSS 25.0 statistics program. Interpretive phenomenological analysis (IPA) was also used [52]. A content analysis [53,54] of the two sets of interview transcripts was used. Once the

interviews were transcribed, they were read in-depth, and the information was categorized, following a constant process of comparison and inductive logic reasoning, as suggested in various research qualitative methodology manuals [55–57]. Thus, the analysis consisted of classifying all the information collected in the interviews into a system of categories and subcategories that simplified, clarified and related the information, giving meaning to the data. The results were analyzed according to the centers of interest and categories.

Results

The analysis of the data is presented below from two perspectives. On the one hand, in a quantitative way and on the other, in a qualitative way.

Quantitative Analysis

First of all, to verify the homogeneity of the two groups before the intervention, an analysis of variance was carried out with one factor, considering as dependent variables (autonomy support, controlling style, basic psychological needs, motivation and involvement) and as fixed factor (the group) finding differences (Wilks Lambda = 0.90, F (16,203) = 5.35, $p < 0.01$, $d = 0.29$), in the controller style variables (F (1112) = 26.19, $p < 0.01$, $d = 0.10$) and controlling motivation (F (1112) = 7.31, $p < 0.01$, $d = 0.03$), in favor of the intervention group; and in the variables autonomy support (F (1106) = 17.93, $p < 0.01$, $d = 0.07$), competence (F (1106) = 11.52, $p < 0.01$, $d = 0.05$), relationship with others (F (1106) = 8.54, $p < 0.01$, $d = 0.03$), autonomous motivation (F (1106) = 39.13, $p < 0.01$, $d = 0.15$), controlling motivation (F (1106) = 23.33, $p < 0.01$, $d = 0.09$) and implication (F (1106) = 23.18, $p < 0.01$, $d = 0.09$), in favor of the control group.

To verify the effect of the pre and post intervention, both in the control group and in the intervention group, the repeated measures analysis was performed, considering the initial

differences that were obtained in all measures. This statistical test allows to control these differences and observe the possible effect that the intervention had, as reflected in the results. When verifying the effect of the program through the analysis of repeated measures (Table 2), significant differences ($p < 0.01$) were obtained in the intervention group, probably due to the lack of randomization in the allocation of units [58]. The values in the variables autonomy, relationship with others, autonomous motivation and involvement improved, and they decreased in controlling motivation. Conversely, in the control group, significant differences were found ($p < 0.01$) in the variables autonomy, autonomous motivation, controlling motivation and involvement, decreasing the values in T2.

Table 2. Analysis of repeated measures.

		Intervention Group (n = 113)		Control Group (n = 107)	
		M	*DT*	*M*	*DT*
Autonomy	Pre	3.84	0.76	3.95	0.72
	Post	4.28 **	0.63	3.41 **	0.85
Competence	Pre	4.30	0.59	4.55	0.46
	Post	4.60 **	0.57	4.48	0.50
Relationship with others	Pre	4.05	0.67	4.32	0.70
	Post	4.49 **	0.64	4.36	0.67
Autonomous motivation	Pre	5.42	0.77	6.32	0.63
	Post	5.86 **	0.74	5.48 **	0.73
Controlling motivation	Pre	4.51	0.83	4.22	0.77
	Post	3.68 **	108	3.72 **	0.68
Involvement	Pre	5.50	1.00	6.09	0.78
	Post	5.92 **	0.88	5.44 **	0.80

Note: * $p < 0.05$; ** $p < 0.01$.

Qualitative Analysis

In order to complement the measures obtained through quantitative information, a focus group was conducted with a sample of students who participated in the process, both from the control group and the intervention group. The purpose of the meeting was explained to them, and once they agreed, they were asked to sign the informed consent. They were randomly selected, but their time availability was taken into account. The dynamics took place for about 45 min, with the

facilitation of the principal investigator. Open questions were posed, aiming at delving into central aspects of the research such as the student's perception of their teachers in relation to their ways of relating and conducting the class, emphasizing the opportunity they have or not to make decisions, make proposals, disagree, participate, interact during class, develop tasks, perceive themselves competent and satisfied.

In the same sense, a focus group was conducted with a sample of the teachers, randomly selected, who participated in the process. The dynamics were also facilitated by the principal investigator. Although open questions were designed, there was also an opportunity to generate other questions derived from the development of the activity. Both of them were oriented to deepen into central aspects of the investigation.

For the interpretation and analysis of the results derived from the qualitative measurement instruments, processes similar to those of other studies [59,60] were carried out, following the methodological indications of Hsieh and Shannon [61]. In the analysis of the videos, in particular, it was proposed to distinguish the different behaviors and statements of the teachers according to how they approximate a teacher's motivating interpersonal style of control, autonomy support or neutral [62].

Student Interviews

After advancing the focus group with the students and analyzing the information, everything was structured into three categories and five large blocks or subcategories, as shown in Table 3. The three categories correspond to teachers, the second to goals and the latter for purposes. As for the subcategories, they are condensed in a first block on the "style of autonomy support" by the teacher; a second block on "high self-determined motivation;" a third on "competence;" a fourth on the "relationship with others;" a fifth and last block on "well-being."

Table 3. Category and Subcategory System after Student Group Data Analysis (Posttest).

Categories	Subcategories	Codes
Teacher	Autonomy support style	Controller
		Autonomy support
		Both styles
Goals	Autonomy	I can make decisions during classes
		I can make proposals during classes
	Competence	I have received guidance from the teacher
		I have been able to understand the issues
		Homework is affordable
	Relationship with others	When I do work with my colleagues I learn more
	High self-determination motivation	Maintaining a high involvement
Effects	Psychological well-being	I feel good in my classes and I feel like I am learning
		I like my career and I want to move on

Autonomy support style. It becomes palpable that the professor's respectful, close and kind attitude with his students is considered relevant, as well as his openness and trust since it facilitates not only the recognition of the professor as an expert but also the assessment of his qualities as a person. On the other hand, it facilitates the learning process because it allows a greater understanding on the part of the students, since, in addition to being structured within the framework of a clear and pleasant language, it allows the formulation of questions and answer alternatives. An example of a statement is: "I believe that one takes more confidence with her, it is easier to ask her, we continue to see her as a person who has knowledge and who knows" (E2).

Autonomy. The possibility of choosing between alternatives, proposing and being able to make decisions was key for the students, as it promoted participation, involvement and interest in the development of the subjects. Some expressions collect this experience and give proof of it: "The teacher gives us several solution options, several alternatives" (E2).

Competence. Perceiving themselves as capable and competent represented for the students a fundamental element in their training process, which, added to a close relationship with the teacher and the opportunity to decide, led them to commit even more to their process. In the following expression, the scope of this aspect is evidenced in the words of the students: "(the

teacher) first explains the importance and then explains the process how it is done, and then leaves us free development" (E2). In contrast, the control group students recognize the complexity of the subjects and the limitations they have to assimilate them: "it really is difficult. There are ugly subjects and the teacher does not help, he does not present them easier and I feel bad and worse if I lose the exam, because I see that I am not learning" (E2GC).

Relationship with others. Collaborative learning, meeting with peers and the establishment of open, dynamic, reciprocal and respectful relationships promote an appropriate environment for learning and are considered a very important factor by the students in the classroom. The following are some of the expressions that reflect this feeling in the students: "I think the relationship with my classmates is important. I feel that with them I can talk about my things and learn more" (E1).

High self-determined motivation. It is observed that although the grades are important, they are not more important than the fact of learning, to the point that there can be satisfaction, even when they are not very good or even insufficient. This motivation allowed the students to attend classes with greater regularity and a willingness to learn and grow as professionals in training and as individuals. Here are some expressions that reflect this dynamic: "I never missed that class, I always kept motivated because I am really learning" (E3 Wellness.); or "I am mainly motivated by the desire to grow personally and professionally" (E4).

For the student, feeling good, full and finding personal well-being is presented as a key within their entire educational journey. The teacher is recognized as an important "partner" on this path, but he is also the student as an active subject and agent of the process. This experience of well-being is reflected in expressions such as "We are motivated to continue, make us want to do it again" (E1); "And you also say I got it, because one also needs personal satisfaction and not to say I did it wrong again" (E2); "I am satisfied with my life, we always want more because we are a little

ambitious" (E4). Meanwhile, the control group students agree that they feel good when they win the subject and simply pass the level.

Teachers Interview

After the intervention process, the focus group was carried out with a sample of teachers. Once this was concluded, the information was analyzed. It was structured into three categories and five large blocks or subcategories, as shown in Table 4. The three categories correspond to teachers, the second to goals, and the last to effects. As for the subcategories, they are condensed into a first block on paper in the classroom focused on autonomy support, a second block on motivation, a third on competence, a fourth on the relationship with others and a fifth on satisfaction.

Table 4. System of Categories and Subcategories after the Data Analysis of the Group of Teachers (Posttest).

Categories	Subcategories	Codes
Teacher	Role in the classroom centered on Supporting Autonomy	Controller
		Autonomy support
		Both styles
Goals	Autonomy	Decision-making during classes
		Proposals during classes
	Competence	Orientations to students
		Facilitation of understanding of topics
		Approach affordable tasks
	Relationship with others	Facilitation of teamwork for greater understanding
	Motivation	Promote high engagement
Effects	Satisfaction	Promote well-being in classes for greater learning
		Promote appropriation by career and permanence

Role in the classroom focused on autonomy support. Teachers recognize that they are facilitators of the student's learning processes through the practice of the motivating interpersonal style of autonomy support. They live an experience between guiding and letting them go: "I believe that this exercise that we did during this semester for me was to confirm the role of facilitator especially at this educational level."

Autonomy. Within the framework of the classroom process, in addition to recognizing themselves as facilitators, teachers consequently recognize students as agents responsible for their learning. They are given the possibility to choose, ask, dispute and propose: “the student is responsible for their learning, for me the student has to assume to assume, I feel that this time I had students who, even though their grades were not 5, they appreciated the possibility of stimulating decision-making, the possibility of thanking us for indicating that we are responsible for this” (P1). In contrast, in the focus group that went ahead with the teachers of the control group, different views were observed regarding the emerging subcategories in the intervention group. Conceptions focused more on control and reflected in expressions such as “students have to conform to what is established, to the rules of the game so that the class functions” (P1GC) denote this.

Competence. In this facilitation process, teachers recognize that they must accompany students along a path that must become more complex in such a way that they feel progressively competent and capable of moving forward. For this reason, it is not enough to enable a close relationship or a scenario of autonomy, but also of competition: “the fact that the student is autonomous, that the student decides that is his responsibility, is also accompanying him to the side, neither behind nor forward, if not to the side” (P1).

Relationship with others. In this process, the teachers also realized that it is not enough for them to facilitate, guide and promote; it is not even enough that students take ownership. They realized that the relationship between students, as peers and classmates, is essential to achieve learning. The teachers are aware of this, and they also insist on proposing didactics and pedagogies that stimulate this relationship: “There was a student who did not know how to interpolate so I stayed with him and taught him and then he was the one who explained to the classmates who did not understand” (P6). Even as a result of this relationship with others, a transformation occurred to the point that the student “is capable of leading his classmates” (P1). On the other side, although

the teachers of the control group established harmonious relations with their students, there is a distance that does not make them warm and close: “I am close to the students, but they there and I here” (P2GC).

Motivation. It was a central component in the process, since as far as the student was concerned, it was a consequence of achieving competence, autonomy and relationships with others, starting from the teacher’s motivating interpersonal style of autonomy support, and regarding the teacher, an engine for the development of their role in the classroom. Both elements are combined and enriched as expressed by the teachers “my motivation is to see the transformation of the student, it satisfies me and in fact that is why I am here” (P5); “The growth of my students motivates me” (P7).

Satisfaction. Throughout the experiential journey, the teacher finally expresses a vocational theme. He is not only a teacher for a job, for an income. It is a matter of will, desire and a life project that seeks personal fulfillment and also to the students, and translates into satisfaction and well-being, which was also experienced by the students. This is how the teachers express it: “I feel that I enjoyed the process, because it was like getting out of neutral and doing something different” (P5); “We enjoyed it and the students too” (P7). “I think it is important to leave traces (...) and it is satisfactory to be able to help him a little in the life of that student” (P6): “For me it was satisfactory, I also felt that I grew as a teacher that my students were motivated” (P3).

Analysis of the Videos

The three dimensions of the teacher’s motivating interpersonal style (control, autonomy support and neutral) were analyzed, both in the intervention group and in the control group, through the review of the class recordings throughout the process, taking as a guideline what is proposed by Pearlman [46], who considers a predominant dimension one that occurs in 80% of the

behaviors observed. As presented in Table 1, in more than 80% of the interactions of the teachers in the intervention group, the teacher's motivating interpersonal style of autonomy support predominates. Similarly, in the control group, 80% of the interactions were characterized by a controlling style. These findings confirm the suggested hypothesis that the intervention group would obtain a more positive result in the measures of the variables.

Discussion

The objective of this study was to evaluate the effect of an intervention with autonomy support on the involvement of college students, taking the framework of the SDT as a reference and from a quantitative and qualitative analysis perspective. After the intervention, the results showed that the Intervention Program with Teacher Autonomy Support achieved, in general, more adaptive behaviors in university students. In turn, it is qualitatively supported by the analysis derived from both the focus groups and the videos taken throughout the intervention.

The intervention had a positive effect because the students who received greater autonomy support presented a greater satisfaction of basic psychological needs [45,63]. These results coincide with previous studies and confirm that the use of the teacher's motivating interpersonal style of autonomy support favors improvements in student motivation [19,20].

The social context and relationships have a significant impact on basic psychological needs and well-being, being able to enhance or affect them [15], and are key to the influence that teachers have on student motivation [64]. This way, the more the teachers implement a motivating interpersonal style of autonomy support during their classes, the greater the student's involvement, levels of autonomy, competence, relationship, self-determined motivation [65] and involvement [22,34,35]. As a consequence, the closer and gentle treatment of the teacher with his students has been key since he has built trust and openness for meeting and discussion in classroom spaces.

Strategies of educational autonomy support that stimulate the development of self-determined motivation can lead students to become more engaged in their academic activities [38]. Satisfying the psychological needs of competence, autonomy and relationships with others through the implementation of strategies that promote the use of a style of autonomy support in the classroom, which for the present study were 25 (Table 5) and were implemented according to the quasi-experimental study protocol of Moreno-Murcia et al. [66], self-determined motivation was improved in the students, in the same sense explained by Núñez and León [43]. The predictive power of the interpersonal style of autonomy support over improvement in academic competence was also observed [67,68].

The need to establish the importance of the basic psychological needs of autonomy, competence and relationship with others is evidenced in order to create learning environments focused on a style of autonomy support that is conducive to improving and maintaining the involvement of students [38,68] and, depending on this, its permanence, persistence and academic success [32,33]. Therefore, on top of a good relationship with their peers, the possibility of students to choose and propose impacts on involvement, adherence to learning processes and satisfaction with life. In addition, when the students perceive themselves capable in this process, their well-being, performance and motivation increase overall.

This study makes contributions to pedagogical nature, demonstrating the importance of implementing strategies to enhance student motivation and their involvement in academic processes. This way, to allow the choice of content among different options, offer level options in the tasks, facilitate teamwork and active participation within the framework of close relationships in class, guide students in the construction of knowledge and searching for answers within a non-controlling language and autonomy support framework are key strategies to consolidate greater motivation and involvement in students [45,69]. Likewise, the establishment of a pleasant and

empathetic language is a determining component that translates into a clearer learning process, with greater understanding and greater possibilities of horizontal interaction. On the other hand, the results suggest promoting a much broader and more diverse university teacher training, focused not only on a deep specialization and experience in an academic and research area but also on the mastery of effective teaching-learning strategies focused on the teacher's motivating interpersonal style of autonomy support [11].

Among the limitations of the study are the need to increase the intervention time and the inclusion of other variables of analysis such as resilience, self-concept and satisfaction with the student's life, verifying the transcontextual effects of the benefits of implementing a support style to autonomy in class. Another limitation is that it only focuses on academic involvement as a result of supporting autonomy. Involvement is one of many possible behavioral outcomes derived from mobilizing the student's internal resources. Future works should complement this preliminary data with information provided by other expected consequences of this style of an emotional, cognitive or behavioral nature. Among the limitations, it is also found that by not having used an active control group, it will be necessary to take it into account in future studies, since the differences obtained in the present work presume that there may be other variables not analyzed that could have modified the results. Regarding the practical implications, although these results are presented as preliminary, we think that this research may contribute to a better understanding of how the educational system can contribute to improving the academic results of students thanks to teacher training in more adaptive styles. Thus, we suggest, aligned with other research, that teacher training programs aimed at modeling interpersonal behavior with their students be promoted. In our study, we have verified how through this monitoring, the teacher who focuses his work on guaranteeing student decision-making, supervising the learning process during the execution of tasks and

supporting social relationships, manages to improve motivation towards proposed activities and finally the student decides to sustain a greater involvement and sustained interest towards them.

Finally, it is considered that sustainable development is only possible when different work fronts are integrated, as proposed by the UN in the Sustainable Development Goals [70] and in particular, in objective 4 Quality Education, in which it raises the challenge of having qualified teachers who accompany students on the path of relevant and effective learning that allows them to access a decent job or entrepreneurship, which in turn contributes to sustainable development.

Table 5. Strategies for the interpersonal style of autonomy support [66](Moreno-Murcia et al., 2019).

Context Description	Autonomous Strategy
During the class, when the teacher proposes a teaching–learning situation ...	Ask the student about their preferences in relation to a task.
In the development of the class, the teacher when set the tasks ...	Offers the possibility of choice to the student (groups, materials and spaces).
In the approach of the tasks, on the taking of student decisions about their intervention, the teacher ...	Let the student take the initiative (gives the initiative).
The teacher, on the possibility of consolidation, expansion or reinforcement of objectives pursued with homework ...	Offers possibilities for experimentation (individualizes the teaching).
The teacher, when organizing tasks, manifests expectations towards the group so that ...	Assigns responsibility by stating its positive expectations and confidence that It will come out well.
Regarding the information that the teacher gives the students before starting a task ...	When starting the task, explain and relates it to Class objectives.
Before starting the practice, the teacher, on the possibility to locate that task within the class structure ...	Locate the task within the class structure (organization).
The teacher offers arguments about the social transfer that has the realization of a activity ...	Explain the usefulness of homework.
The teacher, when he needs to illustrate before starting, class ...	He relies on students as positive role models to demonstrate.
When a task is presented, on the possibility of guiding on personal improvement with criteria for the student, the teacher ...	Does so by offering guidelines and orientations to regulate personal progress and makes the criteria for improvement known in advance.
The teacher during the execution of the activities ...	Adapt directions based on student progress.
When the teacher needs to illustrate the tasks once they have started ...	Use role models through students.

On whether the teacher participates in the explanations of the tasks ...	When necessary, share the demonstrations with the students.
On the variants that the teacher can offer during the development of a task ...	Remember the different variants for the same task.
During the performance of the tasks, the teacher ...	Offers both verbal and non-verbal positive reinforcement. Encourage students to persevere.
The teacher, during the development of the activities, ...	Offers informative and/or positive feedback during the execution of tasks
The teacher usually raises the activities in such a way that ...	Offers a graduation of the difficulty of the tasks according to the level of the students.
During the activities, the teacher ...	Proposes flexible groupings according to the development of the tasks.
During the development of the session, the teacher ...	Addresses students with education and on an individual basis.
When students talk to the teacher, the teacher ...	Uses empathetic language.
The teacher during the development of the class ...	He approaches the students to attend to them.
The teacher when interacting in class ...	He is enthusiastic.
The teacher during the development of the class ...	Gives confidence to the students.
The teacher during the development of the class ...	Behaves as a positive role model for students.

Conclusions

This research joins a growing research force that, from the SDT, combines quantitative techniques with the information provided by qualitative techniques to achieve a better knowledge of the variables that participate in a quality educational context from teacher training. This study suggests that in order to achieve greater academic involvement of students, teachers should first be able to mobilize their academic motivation by promoting psychological mediators, minimizing the use of controlling behaviors. Therefore, it is necessary to train teachers in structured programs that help them implement these strategies in their classes to achieve the expected results.

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Otras publicaciones que hacen parte de la tesis doctoral

Artículo 3

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Huéscar, E., Lozano-Jiménez, J., De Roba, J., y Moreno-Murcia, J. (2021). Relationships among instructor autonomy support and university students' approaches to learning, perceived professional competence and life satisfaction.

Relationships among instructor autonomy support and university students' approaches to learning, perceived professional competence and life satisfaction

Elisa Huéscar Hernández, José Eduardo Lozano-Jiménez, Jose Miguel de Roba Noguera, and Juan Antonio Moreno-Murcia,

Abstract

The purpose of this study was to examine relationships among instructor autonomy support for student learning and students' motivational characteristics, learning approaches, perceptions of career competence and life satisfaction. Participants in this study were 1048 students from various Spanish universities with ages ranging from 18 to 57 years. Structural equation modeling was utilized to assess the proposed model and revealed a relationship between instructor autonomy support for student learning with students' basic psychological need satisfaction. In turn, students' basic need satisfaction was related to their intrinsic motivation and to a learning approach dedicated to deeper learning. These educational outcomes contributed to the explanation of students'perceived professional competence and life satisfaction. These findings highlight the importance of student choice and decision-making in the learning process as a means of facilitating deeper learning, stronger feelings of professional competence, and enhanced well-being.

Key words: self-determination theory; academic motivation, focus of learning; perceived professional competence.

Introduction

Current workplace demands necessitate that university students not only acquire theoretical knowledge but that they also develop the capacity to "learn how to learn" in order to have the

capacities necessary to adapt to rapidly changing workplace demands in a self-directed manner (Moreno & Morales, 2017). As part of the university model that is promoted through current initiatives (*Espacio Europeo de Educación Superior*), the current focus for higher education is grounded in the development of varied student competencies, and proposes methodological approaches to the teaching/learning process in which graduating students have received adequate preparation based in competencies that will be transferable across varied contexts. In addition, specific content-area competencies are needed that will enable success in any given educational, workplace and social contexts.

In relation to the goal of optimizing the anticipated fit between the academic environment and the future employment demands that will be placed upon students, it is recommended that the relationship between universities and professional workplace associations be strengthened through appropriately designed university curricula (Suárez, 2014). Recent work in this area has proposed that student courses of study incorporate this focus and reformulate the academic competencies with an eye on future professional necessities (Izquierdo, 2015; Izquierdo & Farías, 2018; Moreno, Barranco & Díaz, 2015). In essence, the student role would change to become more process-oriented rather than the current content-oriented focus in learning (López, 2011). This outcome could be achieved through a greater appreciation that professional and personal development must reflect the dynamic nature of the workplace and the need for individuals to be able to adapt to change (Salmerón, 2013).

Self-determination theory (SDT: Ryan & Deci, 2017) has been a widely used theoretical framework from which to understand student motivation in relation to cognitive/academic, behavioral and emotional outcomes (Owen, Smith, Lubans, Ng, & Lonsdale, 2014). It has been proposed by theorists that the satisfaction of basic psychological needs (BPN) will contribute to

a host of positive and adaptive outcomes (Kaplan, 2017). One highly relevant influence in the learning environment involves the teacher/student interactional style during the learning process, which is typically considered to reflect the pattern of interpersonal processes that occur between teachers and students while students carry out their work (Reeve, 2016). From this perspective, classroom interactional practices are nutriments that contribute to the internal motivational resources of the student and an autonomy-supportive instructional style should be beneficial in the realization of this goal (Reeve, 2016). Research indicates that an autonomy-supportive instructional style is associated with students acquiring knowledge in a reflexive manner and that this style also increases student participation, self-confidence, self-esteem, commitment, initiative and enthusiasm for learning (Cheon & Reeve, 2015; Hernández, Arán, & Salmerón, 2012; Jang, Kim, & Reeve, 2016; Núñez, Fernández, León, & Grijalvo, 2015). These beneficial outcomes reflect a state of meaningful learning (Hernández, Rosario, & Cuesta Sáez de Tejada, 2010) and seem to contribute to the improvement of academic performance (Gutiérrez & Tomás, 2018). To the contrary, instructional styles that reflect teacher control or hostility are associated with maladaptive student outcomes (Tilga, Hein, Koka, Hamilton, & Hagger, 2019).

Self-determination theory presents a continuum of motivational styles that includes intrinsic motivation, extrinsic motivation and amotivation. The preferred type is intrinsic motivation which is self-determined in nature and is characterized by the student's desire to gain knowledge and to experience stimulation in the learning process. Extrinsic motivation is less self-determined and ranges among four expressions that are labeled external regulation, introjected regulation, identified regulation and integrated regulation. These four expressions of extrinsic motivation vary in the extent of self-regulation. A final point on the motivational

continuum is amotivation, which refers to the absence of motivation, whether it be intrinsic or extrinsic. At a broader level, motivation can be differentiated between autonomously regulated forms of motivation, which include intrinsic motivation and identified and integrated regulation and controlled motivation which consists of extrinsic motivation and externally regulated and introjected forms of motivation (Deci & Ryan, 2012). More autonomously regulated forms of motivation should be expected to result from those learning contexts in which choice and initiative is encouraged from the student (Vansteenkiste, Lens, & Deci, 2006) as these behaviors seem to drive a sense of satisfaction as the individual develops competencies (Hernández, Silveira, & Moreno-Murcia, 2015).

Autonomous forms of motivation and the corresponding satisfaction of basic psychological needs are anticipated to contribute to psychological well-being in students of higher education and to result in greater self-esteem and more favorable academic self-concept whereas controlled forms of motivation inhibit psychological need satisfaction and have also been linked to anxiety and lower levels of self-esteem (Cheon, Reeve, & Song, 2016). Meaningful learning ought to be a fundamental component of the approach to the new model of developing academic competency where the student acquires knowledge as the foundation of cognitive processes but in such a way as to lead to a higher level of thinking and a deeper understanding of interdisciplinary knowledge that is useful and relevant (Hernández et al., 2012; Mérida, 2013). Students can also adopt different approaches to learning in accordance with the nature of the academic learning environment (González, Del Rincon, & Delio, 2011). A constructivist approach to learning is considered to be one in which students actively engage in deeper learning processes (Doménech & Gómez, 2011) whereas a superficial approach (Dart et al., 2000) is used to describe the strategies employed by those who seek to memorize content

without making efforts to engage in a broader application of their learning. These learning approaches have also been related to the student's type of motivation (Biggs, 1989) and to the extent of psychological need satisfaction that the student experiences given that when the basic psychological needs (BPN) are satisfied that students will employ a wider variety of learning strategies, adopt fewer avoidance strategies and be more likely to attain a higher level of academic performance (Gargallo, Garfella, & Pérez, 2006; Herrmann, Bager-Elsborg, & McCune, 2016).

Some researchers have assessed the relationships among students' level of autonomy support, their academic competencies and their approaches to learning from the framework of self-determination theory (Moreno-Murcia, Ruiz, Silveira & Alias, 2017; Moreno-Murcia & Silveira, 2015). However, research has yet to be conducted relative to the influence of autonomy support upon feelings of perceived professional competence and life satisfaction outcomes. As a consequence of the preceding logic relative to the importance of autonomy support for students in the university phase for the acquisition of competencies, the purpose of this study was to assess the predictive strength of instructor autonomy support, level of basic psychological need satisfaction, and academic motivation on the processes of deep learning and corresponding effects on perceived professional competence and life satisfaction of students. It was hypothesized that autonomy support would be positively associated with satisfaction of the basic psychological needs and with intrinsic motivation. In addition, autonomy support was anticipated to predict students' approaches to learning which, in turn, would contribute to the explanation of perceived professional competence and life satisfaction.

Method

Participants

The sample was comprised of 1048 university students, including 365 males (34.8%) and 683 females (65.1%). The participants ranged in age from 18 to 57 years of age (*M* = 22.17 yrs., *SD* = 4.20 yrs.) and attended various Spanish universities and were engaged in a program of study related to sport and exercise science or psychology.

Measures

Autonomy support. The Teacher´s Care Scale developed by Saldern and Litting (1987) and validated for use in the Spanish language and educational context by Moreno-Murcia, Ruiz, Silveira and Alías (2017) was employed to assess instructor support for student autonomy. On this instrument, students respond to the common stem phrase of, "Our teacher…" to questions that relate to students' perceptions of their instructor's interest and involvement in their learning (e.g., "Is concerned about student problems"). This instrument includes four items and the response format utilizes a Likert-type scale with response choices that range from "1" ("*Never or almost never*") to "4" ("*Frequently true for me*"). The Cronbach alpha internal consistency value for this scale was .81 in the present study. Assessment of the instrument's factor structure through confirmatory factor analysis revealed good fit (fit indices of $\chi 2/g.l.$ = 5.15; *CFI* = .99; *IFI* = .99; *RMSEA* = .06).

Basic psychological needs. The assessment of satisfaction of basic psychological needs was conducted through the Basic Psychological Need Satisfaction in Education Scale (*Escala de Satisfacción de las Necesidades Psicológicas Básicas en Educación*) developed by León, Domínguez, Núñez, Pérez and Martín-Albo (2011). This instrument is a Spanish language modification of the original French language scale by Gillet, Rosnet and Vallerand (2008). The

instrument consists of fifteen items that assess satisfaction of the three basic psychological needs and the individual's perceptions of autonomy (e.g., "I feel free to make my own decisions"); competence (e.g., "I feel that I can do things well"); and relatedness (e.g., "I feel good about the people with whom I interact"). Student responses are provided on a five point Likert-type scale that ranges from "1" ("*totally disagree*") to "5" ("*totally agree*"). The Cronbach alpha values of internal consistency in the present study for the individual dimensions were .76 for competence; .68 for autonomy; and .80 for relatedness. Fit indices in the present study were: χ2/g.l. = 6.8; *CFI* = .91; *IFI* = .91; and *RMSEA* = .074.

Academic motivation. To assess student intrinsic motivation for academic work, the Scale of Motivation in Education (Vallerand, Blais Brier, & Pelletier, 1989) was used. This scale has been translated from its original French language form and validated for use in the Spanish language and cultural context by Nuñez, Martín-Albo, and Navarro (2005). The common stem phrase across all questions is, "Why do you study?" and each subscale contains four items. The subscales of Intrinsic Motivation To Know (e.g., "Because my studies allow me to learn many interesting things"); Intrinsic Motivation To Succeed (e.g., "For the satisfaction that I feel when I have succeeded in learning difficult academic content); and Intrinsic Motivation To Experience Stimulation (e.g., "Because I really enjoy attending classes"). Responses are provided along a 7-point response format ranging from "1" ("*absolutely doesn't correspond*") to "7" ("*corresponds totally*"). Cronbach alpha internal consistency estimates obtained in the present study were .85 for Intrinsic Motivation to Know; .81 for Intrinsic Motivation to Succeed; and .73 for Intrinsic Motivation to Experience Stimulation. Indices of fit obtained through confirmatory factor analysis were χ2/g.l. = 5.8; CFI = .96; IFI = .96; and RMSEA = .068

Approaches to Learning. The Revised Questionnaire of Approaches to Learning (RQAL), in its original Spanish language version (Cuestionario Revisado de Procesos de Estudio: *R-CPE-2F*, Recio & Cabrero, 2005), was utilized in this study. The instrument contains ten items that assess deep interest in learning with two subscales that assess deep motivation to learn and deep learning strategies. There is a common stem question across both subscales for each item, "In this class…" for both the deep motivation (DM) subscale (e.g., "Sometimes studying gives me a feeling of deep personal satisfaction") and deep strategies (DS) subscale (e.g., "I dedicate a lot of my free time reviewing information about interesting themes and concepts that have been covered"). The instrument uses a five-item Likert-type response format ranging from "*Never or almost never true for me*" to "*Always, or the majority of the time, it is true for me*". Obtained fit indices were: *χ2/g.l*. = 4.6; *CFI* = .94; *IFI* = .94; *RMSEA* = .59.

***Perceived Professional Competence*.** The Perception of Professional Competence Scale developed by Moreno-Murcia and Silveira (2015) was used in the present study. The purpose of the instrument is to assess students' perceptions of the relevance of their academic knowledge to their anticipated future career and workplace demands. Responses were completed in relation to the common stem question of, "What my instructors are teaching will permit me to be capable of …" and a sample item is, "to understand the structure, function and unique phases of my academic learning". Responses are provided along a 7-point format ranging from "*completely disagree*" to "*completely agree*". A Cronbach alpha value of .89 was obtained for the scale in the present study. Indices of fit obtained for this instrument were: χ2/g.l. = 1.7; *CFI* = .99; *IFI* = .99; *RMSEA* = .026.

Life satisfaction. The Life Satisfaction Scale (L'Échelle de Satisfaction de Vie) de Vallerand et al. (1989) and validated in the Spanish language and cultural context by Atienza and colleagues

(Atienza, Balaguer, & García-Merita, 2003) was employed for this study. Participants responded to items that contain a common stem phrase of "Satisfaction with your life…" in relation to five items that represent a single factor (e.g., "In general, my life corresponds with my ideals". A seven-point response format is used that ranges from "*totally disagree*" to "*totally agree*". Internal consistency estimate for this instrument was .83 and the obtained indices of fit were: χ2/g.l. = 1.6; *CFI* = .99; *IFI* = .99; *RMSEA* = .025.

Procedure

Contact was made first with the instructors to inform them of the objectives of the study and to request their permission to allow their students to complete the questionnaires during class time during required courses. The purpose of the study was explained in a generic way to the participants and researchers were present to help address any issues that may have been present during the process. Participants were informed that their involvement was entirely voluntary and that they could discontinue their involvement at any time. Students typically required about twenty minutes to complete the questionnaire.

Data Analysis

In order to provide a test of the proposed model, structural equation modeling was used to assess the fit of a model that tested relationships among student autonomy support, psychological need satisfaction, intrinsic motivation in academics, workplace competence and life satisfaction. The statistical packages of SPSS 25.0 and AMOS 24 were used.

Results

Means and standard deviations were computed for all variables and are provided in Table 1. The mean for instructor autonomy support was 2.39 which is near the midpoint of the scale's

range. Correlations among variables were also computed and significant relationships existed among each set of variables.

Structural equation model

The proposed model was assessed to determine if the number of latent variables could be reduced on some of the factors. The result was that the autonomy support factor remained comprised of four items and basic psychological needs remained comprised of three factors (competence, autonomy and relatedness) with five items contributing to each. The intrinsic motivation construct that represented self-determined motivation consisted of the three factors (intrinsic motivation to succeed, intrinsic motivation to know, and intrinsic motivation to experience stimulation) and four items represented each factor. The deep learning construct remained unchanged and consisted of the two factors, motivation and strategies, with each variable consisting of five measured items. Finally, the social competence and life satisfaction factors were comprised of eight items and five items, respectively as in their original structure.

Test of proposed model

The maximum versimilitude procedure along with bootstrapping methods were employed ($\chi 2 = 9469.5$, $p < 0.01$, $\chi 2/d.f. = 3.81$, $CFI = .94$, $IFI = .94$, $TLI = .92$, $RMSEA = .05$) and revealed a positive relationship between instructor autonomy support and student basic psychological need satisfaction which, in turn, was related to intrinsic motivation and, consequently, a focus on deeper learning. The deeper learning variable predicted perceived career competence which, in turn, contributed to the explanation of life satisfaction (Figure 1).

Discussion

To date, a limited body of knowledge has been acquired from a self-determination theory perspective in relation to the influence of instructor interpersonal style on student learning

approaches and life satisfaction. The purpose of this study was to examine the predictive capacity of a model that examined the influence of instructor characteristics on student learning approaches and life satisfaction through a model in which basic psychological need satisfaction and intrinsic motivation were proposed as mediators. The results provided support for the proposed pattern of expectations.

With regard to the relationship between autonomy support and basic psychological need satisfaction and, subsequently, intrinsic motivation, this investigation revealed that autonomy support served as a nutriment for basic psychological need satisfaction and resulted in adaptive consequences in terms of greater participation, confidence and commitment by these students and contributed to a positive relationship with intrinsic motivation. This pattern of results has commonalities with previous research in this area (Kaplan, 2017; Hernández et al., 2010; Hernández et al., 2012; Núñez et al., 2015; Vansteenkiste et al., 2012). The implication of these findings is that students benefit when instructors design learning opportunities for which student have opportunities for choice and opportunities for positive interpersonal relationships. This instructional approach has been linked to a more self-regulated form of learning that can contribute to greater student success (León, Núñez, & Liew, 2015). The results of this study also revealed a positive relationship between intrinsic motivation and a deeper approach to learning and is consistent with research that indicates that autonomous learning can be enhanced in this way as opposed to a learning strategy that is primarily reliant upon memorization and repetition (Doménech & Gómez, 2011; Hernández et al., 2010). This approach to learning is also linked to the development of competencies and capacities that allow for stable learning approaches that are dedicated to a more active and deeper learning approach as well as to a more favorable perception of one's future professional abilities.

Although research in this regard is limited, the findings strengthen the expectation that instructor autonomy support has extensive benefits for student learning processes (Bieg, Backes, & Mittag, 2011).

The relationship that was proposed in the structural equation model between perceived professional competence and life satisfaction revealed the presence of a significant, positive relationship between these two variables. No known previous research has been conducted on this relationship but this outcome is consistent with the focus of self-determination theory in that psychological well-being is anticipated to result when individuals experience feelings of autonomy and competence (Ryan & Weinstein, 2009).

Previous research has indicated that instructor support of student autonomy is related to greater perceived social and professional competence (Ortega, 2010; Ryan & Deci, 2009) and can manifest in a more general sense of life satisfaction (Reeve, Ryan, Deci, & Jang, 2008) that may lead to greater student self-confidence about their future occupational roles in society. Some studies in this line of research have examined whether subjective well-being, as an indicator of life satisfaction (Anataramian, Huebner, & Valois, 2008), is positively associated with basic psychological need satisfaction, autonomous motivation and perceptions of competence (Bagoien, Halvari, & Nesheim, 2010). The results that we have obtained reinforce the expectation that motivational benefits that accrue from autonomy support also augment life satisfaction (Brown & Fry, 2014; Gutiérrez, Tomás, & Calatayud, 2017). As such, educators should search for classroom strategies that inspire participation and creativity during the assimilation of knowledge and not only satisfy basic psychological needs but also mobilize the student to seek knowledge in a more active manner that can have the effect of contributing to an enduring learning approach that is dedicated to deep learning (Moreno, Ruiz, Silveira, &

Alias, 2017). In such circumstances, the student may feel that they have the capacities to deal with any of the academic and professional demands that they confront (Hernández, Silveira, & Moreno, 2015; Moreno-Murcia, & Silveira, 2015) and may derive greater life satisfaction in the process. In this regard, it is important to highlight the transcontextual interactions that exist within self-determination theory and Vallerand's motivation model (Vallerand, 1997). In this case, there was evidence of a transcontextual effect from the academic environment (focus on deep learning) with professional consequences (perception of professional competence) and an additional relationship with life satisfaction.

The results of this work have clear pedagogical implications as they highlight the benefits that students accrue when they have instructors who encourage them to take a proactive role in the learning process. In this way, instructors can stimulate students' willingness to initiate the learning process and can contribute to students' desire to gain deeper knowledge and to have the satisfaction of feeling that the knowledge that they acquire will serve them well in the work force and contribute to their life satisfaction.

It should be acknowledged that there are limitations to this study. First of all, this is was a cross-sectional study and so causal relationships cannot be presumed to exist among the variables assessed. Additional experimental and longitudinal studies would be beneficial to provide a test of the strength of the relationships among instructor autonomy support and student learning and life satisfaction outcomes to provide a stronger test of these suppositions. In addition, the structural equation model that was proposed was only one of the possible frameworks for understanding the pattern of relationships among the variables.

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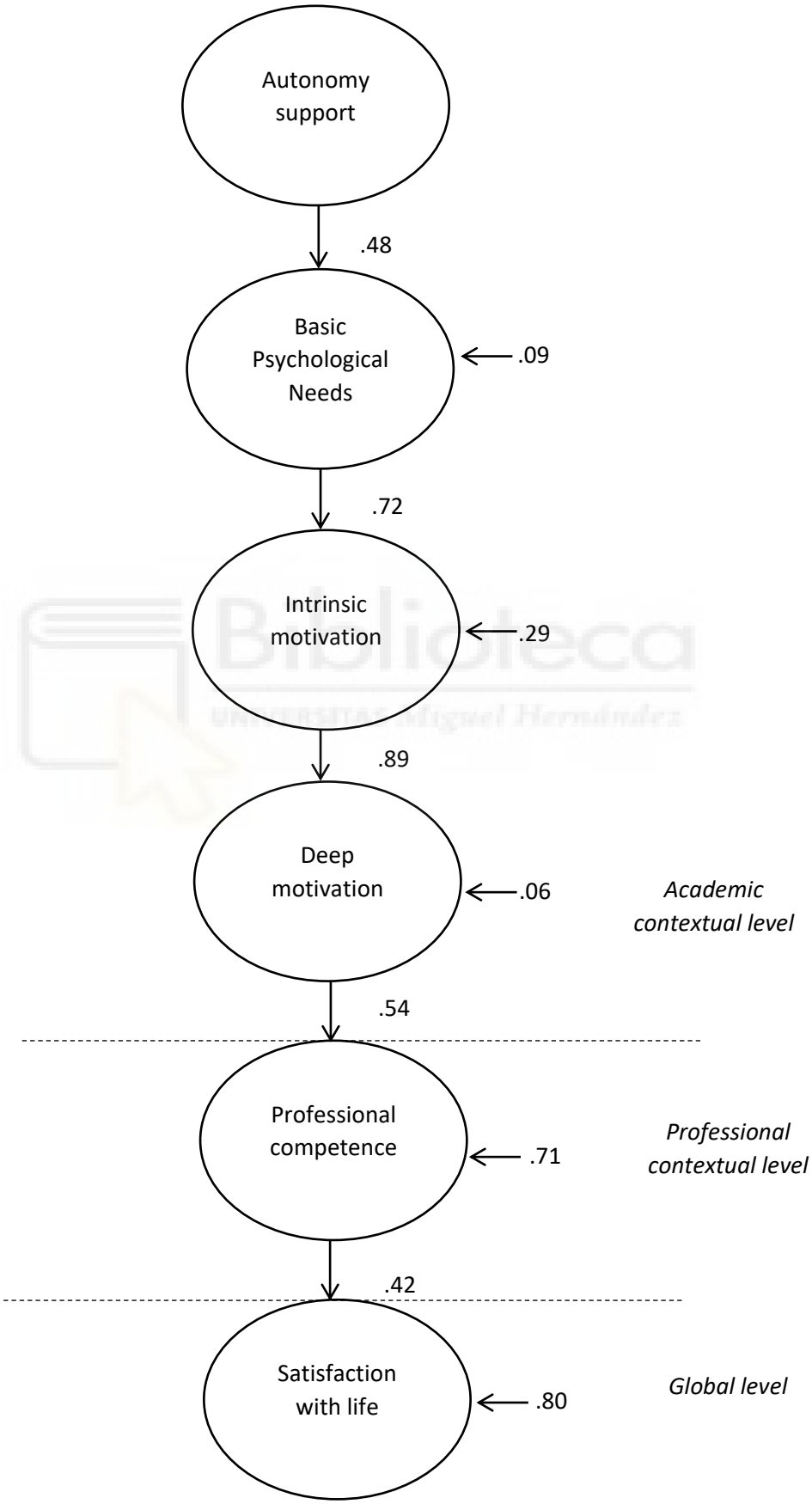
Table 1. Mean, standard deviation and correlations between variables.

Note: ** $p < .001$; IM: intrinsic motivation

	M	*SD*	α	R	1	2	3	4	5	6	7	8	9	10
1. Autonomy support	2.39	.68	.81	4	-	.21**	.33**	.13**	.18**	.21**	.16**	.37**	.21**	.11**
2. Competence	3.97	.58	.76	5	-	-	.39**	.49**	.34**	.37**	.33**	.36**	.32**	.34**
3. Autonomy	3.17	.72	.68	5	-	-	-	.30**	.15**	.19**	.23**	.34**	.17**	.25**
4. Relatedness	4.24	.60	.80	5	-	-	-	-	.20**	.22**	.24**	.26**	.08**	.23**
5. IM knowledge	5.06	1.09	.85	7	-	-	-	-	-	.68**	.56**	.42**	.52**	.27**
6. IM achievement	4.98	1.13	.81	7	-	-	-	-	-	-	.53**	.50**	.45**	.30**
7. IM experiences	4.26	1.24	.73	7	-	-	-	-	-	-	-	.39**	.40**	.26**
8. Laboral competence	4.89	1.02	.89	7	-	-	-	-	-	-	-	-	.33**	.36**
9. Deep motivation	2.96	.59	.77	5	-	-	-	-	-	-	-	-	-	.18**
10. Satisfaction with life	5.37	1.00	.83	7	-	-	-	-	-	-	-	-	-	-

Figure 1. Structural equation model. Parameters are significant at $p < .05$ and standardized.



Artículo 4

Artículo postulado y en segunda revisión en la Revista de Journal of New Approaches in Educational Research (ISSNe 2254-7339):

Moreno-Muria, J., Huéscar, E., y Lozano-Jiménez, J. (2022). Predictive model for academic succes in university students from the Self-determination Theory perspectiva.

Predictive model for academic success in university students from the Self-determination Theory perspective

Juan Antonio Moreno-Murcia, Elisa Huéscar, José Eduardo Lozano-Jiiménez

Abstract

The objective of the study was to determine the best possible model capable of predicting academic success in university students based on the satisfaction of basic psychological needs, academic motivation, study processes, and perceived academic and social competence. 1172 university students participated (405 men and 767 women) belonging to different Spanish universities, aged between 18 and 57 years (*M* = 22.15, *DT* = 4.22), to whom the questionnaires pertaining to the study measurement variables were administered. The results indicated that the best model built with the random forest algorithm for the prediction of academic success was characterized by a high satisfaction of the psychological needs of competence and relationship with others, greater self-determined motivation, deep learning process and greater perception of competence. academic. The results are discussed regarding the importance of the teacher promoting structured learning environments oriented to the utility of the task to promote better academic results.

KEYWORDS: Autonomy support; Academic motivation; Academic autonomy; Learning process.

1 ARTICLE STRUCTURE

1.1 Introduction

The performance of students in higher education environments is one of the greatest interests of contemporary educational systems, focused on improving the quality of academic processes and achieving high quality recognition (Al Abduwani, 2017). In Spain, a third of new students in undergraduate studies abandon their studies, and although 10% usually demand a change of degree, 14.1% end up leaving the university system permanently (Ministry of Universities, 2021). The Self-determination Theory (SDT, Ryan and Deci, 2017) has represented in recent decades a useful and empirically evidenced approach in the educational field to understand the elements that people need to stay involved in any task. Thus, it argues that the personal variables of the student body related to self-determined motivational processes, that is, that promote inherent internal processes capable of allowing them to decide for themselves and self-regulate their progress to improve their learning, are key in a adaptive academic training process (Vansteenkiste, Aelterman, Haerens, and Soenens, 2019; Yu, and Levesque-Bristol, 2020). Therefore, a large number of works in this line have appeared to help explain the variables involved in the academic performance of the student body, making the prevention of academic dropout one of the greatest challenges for educational institutions today (Ajay et al., 2020).

1.1.1. Basic psychological needs and academic adjustment

The Basic Psychological Needs Theory (BPNT, Ryan & Deci, 2017) is one of the six mini-theories of SDT. He points out that people have three psychological needs that are vitally important for their psychosocial adjustment and motivation. These needs do not imply a deficiency, as could be understood, but rather represent basic nutrients to guarantee optimal

development in any area where the person develops. Thus, the specialized literature in the educational field has been indicating that when the Basic Psychological Needs (BPN, Ryan & Deci, 2017) of autonomy, competence and relationship with others are satisfied in the student, it is positively associated with the related variables with academic adjustment (Ahmad, Vansteenkiste & Soenens, 2013). Autonomy involves volitional aspects and the organization of behavior based on the integrated sense of self, in which students perceive that they can choose and control the consequences at a certain point. For example, when students perceive that they can choose regarding the execution of tasks and that their preferences are taken into account, the need for autonomy is being satisfied. Competency refers to the student's perception of feeling capable and effective in performing their tasks. For example, if the teacher makes the student feel capable of achieving the proposed goals and of being successful in their execution, he will be able to satisfy the need for competence. The relationship with others refers to the need of students to be involved in a meaningful way with others. For example, if the student perceives warm and supportive relationships from the teacher and their peers, they will perceive that their need for relationships with others is being satisfied, improving the quality of social ties (Ryan and Deci, 2000). Abundant studies have indicated that the satisfaction of BPNs encourages autonomous motivation in students and higher academic achievement (Leenknecht, Wijnia, Loyens, and Rikers, 2017). In the same direction, Meng and Ma (2015) point out that autonomy promotes greater effort in carrying out tasks and, consequently, greater performance that allows them to have a better perception of internal control and greater decision-making capacity.

1.1.2. Learning process, motivation and academic competence

However, in the student's motivational process, along with this type of interpersonal variables, other variables of a personal nature (that is, variables of a dispositional nature that are part of a certainly stable trait of the student) participate, such as the predisposition to face learning. The learning process is defined as the way in which students adapt their study strategies to face tasks throughout their academic life (Marton and Säljö, 1976). Thus, the deep learning process is understood as the combination of intentions to understand the tasks and thought processes associated with the relationship of ideas and the use of evidence. Meanwhile, superficial learning takes place when the student's sole intention is to memorize and reproduce academic material without seeking the connection between ideas and knowledge itself (Marton, 1976). Studies have indicated that the learning process, although part of the influence of personal characteristics (Entwistle, 1988) is fundamental to the student's perception of academic tasks (Cabero, 2005). Given the dynamic nature of motivation, associations have been found between the type of student motivation and their learning process (González Geraldo, del Rincón Igea, and Delio, 2010). Specifically, the study process from a deep approach implies that the student places greater emphasis on their own autonomy throughout their knowledge construction process (Hernández, Rosario, & Cuesta Saez de Tejada, 2010), which is associated with the satisfaction of the basic psychological needs of autonomy, competence and relationship with others. In the deep approach the student shows interest or, for that matter, greater intrinsic motivation and is active in the implementation of strategies to understand and learn. In the superficial approach, the student presents less interest, greater fear of failure, and more rote learning (Biggs, Kember, & Leung, 2001). In general, students with a deep study process present a learning process with a more self-

determined motivation, associated with higher academic performance (Boiché, Sarrazin, Grouzet, Pelletier, & Chanal, 2008).

On the other hand, in the search for indicators of students 'academic adjustment, one of the variables that has been thought to be highly valuable in predicting students' academic success is the perception of academic competence, referring to the perception of the student itself about their abilities to successfully develop a task (Edel, 2003). Some studies have pointed out the correspondence between this perception and the actual execution of academic achievement within the framework of quality standards stipulated from national government guidelines, as well as international bodies (Caro and Nuñez, 2017). Although, it is recognized that there are many personal and social variables associated with academic performance (Correa, 2016), there is consensus that this is always measured based on the development of competences in an evaluative framework (Castellanos, Latorre, Mateus, and Navarro , 2017).

Now, when measuring academic performance, the personal variables of a volitional and self-evaluative nature involved in this process play a key role. Motivation has a decisive influence on the results that students obtain in class. Numerous studies highlight the importance of self-determined motivation as a central component in academic performance and learning (Goldman, Goodboy, and Weber, 2017; Jeno, Danielsen, and Raaheim, 2018; Yu et al., 2020), as well as in the social spectrum of experiences related to the educational setting (Mouratidis, Vanteenskiste, Sideridis, & Lens, 2011). Regarding the latter, studies that have focused on subjective aspects related to the student's self-perceived ability to function adaptively at a social level point out the importance of the student perceiving tasks as useful for their professional future (Marty, Frick, Bruderer, and Zundel, 2021). Specifically, in the field of higher education, the involvement of the teacher in the design of activities that connect

classroom learning with daily life and the future of work has gained relevant importance in the last decade, pointing to university institutions as fundamental in the achievement of new competences that can help the student to adapt effectively to the demands of the labor market.

1.1.3. Data mining and Random forest

Based on the technological development of recent years, data mining ((Han, Kamber, and Pei, 2011; Yu et al., 2020) is representing an efficient alternative to help understand the variables involved in academic success, insofar as it allows handling large amounts of data with the In order to discover patterns and hidden relationships necessary for decision making (Bhardwaj and Saurabh, 2011), however, there are still aspects to be explored. Specifically, to date, there are no studies that focus on the theoretical framework of the SDT to explain the variables involved in the academic success of higher education students using machine learning algorithms. To achieve this purpose, data mining applied to education (Romero and Ventura, 2010) is dedicated to using the collection of educational data for the creation of tools that allow evaluating processes related to the educational field by classify a student between the two possible cases that may occur (for example, obtaining a pass or a failure). For this, algorithms or classification techniques are used, one of the most common being decision trees. Thus, based on a classification proposed from the postulates of the SDT and in order to analyze the possibility of making predictions of academic success based on these explanatory variables or data sets, among which is the Random Forest algorithm, the present study is proposed.

To predict the success of students in higher education, based on their academic performance, one of the greatest interests of HEIs (Ajay et al., 2020), and that with them the institutions achieve high quality levels, although there are predictive models available, there is no certainty to determine if a student will have a high or a low performance or if they will drop

out of their academic training process. However, through data mining it is possible to analyze and interpret the data, necessary to obtain meaningful and valuable information, unknown prior to this treatment, which enables strategic decision-making and direct actions (Ajay et al., 2020) Anuradha, and Velmurugan, 2015).

1.1.4. The present study

This study aimed to find a predictive model to predict academic success in university students based on the following variables: satisfaction of basic psychological needs, academic motivation, academic and social competence, and learning process. To do this, based on the theoretical framework of the SDT (Vandenkerckhove et al., 2019), we hypothesize that those students who perceive greater satisfaction from their BPN will show a positive association with quality motivation and with a deep learning process leading to higher perceived academic and social competence.

1.2 Material and methods

1.2.1. Sample

The sample consisted of 1172 university students (405 men and 767 women) belonging to four Spanish public universities, aged between 18 and 57 years (M = 22.15, SD = 4.22), who after being informed of the objectives and investigation procedure agreed to participate voluntarily.

1.2.2. Measures

Psychological Mediators. The Scale of Satisfaction of Psychological Needs in Education (ESNPE) of León, Domínguez, Núñez, Pérez, and Martín-Albo (2011), a Spanish version of the Échelle de Satisfaction des Besoins Psychologiques in the educational context of Gillet, Rosnet and Vallerand (2008) was used. It consists of 15 items to measure three dimensions: perception

of autonomy (eg "I feel free in my decisions"), perception of competence (eg "I have the feeling of doing things well") and perception of relationship (eg "I feel good with the people with whom I interact"). Responses are evaluated according to a 5-point Likert-type scale, ranging from 1 (totally disagree) to 5 (totally agree). The internal consistency obtained was .78 for the competence dimensions, .70 for autonomy and .84 for the relationship with others.

Academic Motivation. To measure the student's academic motivation, the Spanish version translated and validated for secondary education (Núñez, Martin-Albo, Navarro, y Suárez, 2010) of the Academic Motivation Scale, High School Version (AMS-HS-28) (Vallerand, Pelletier, Blais, & Brière, 1992) was used. The instrument is made up of 28 items, preceded by the phrase "Why are you studying?" and distributed in seven subscales, five of them with four items and the remaining two with three: demotivation (eg "I don't know why I go to high school and, honestly, I don't care"), external regulation (eg "In order to subsequently achieve a better salary"), introjected regulation (eg "Because when I do my homework well in class I feel important"), identified regulation (eg "Because it will help me make a better decision regarding my professional orientation"), motivation intrinsic to knowledge (eg "Because my studies allow me to continue learning many things that interest me"), intrinsic motivation to achieve (eg "For the satisfaction I feel when I overcome difficult academic activities") and intrinsic motivation to stimulating experiences (eg "Because I really like going to class"). Responses were scored according to a seven-point Likert-type scale, from 1 (does not correspond at all) to 7 (fully corresponds). The alpha value obtained in this study was .90 for demotivation, .89 for external regulation, .82, .74 for introjected regulation and .82 for identified regulation, .82 for intrinsic motivation to knowledge. 78 for intrinsic achievement motivation and .76 for intrinsic motivation for stimulating experiences. Autonomous motivation refers to the natural tendency

of people to experience a sense of choice and psychological freedom regarding their thoughts and actions (Ryan and Deci, 2017). It is a type of self-determined motivation, either integrated or intrinsic, that has an internal locus of causality and does not require external incentives. On the other hand, controlling motivation is characterized by developing activities oriented by a reward or the avoidance of punishment, from an external locus of causality.

Perception of academic competence. The academic competence dimension of the Losier, Vallerand, and Blais (1993) scale, called Perception of Competence in Life Domains Scale, was used. The academic competence dimension was made up of four items (e.g. “In general, I have difficulty doing my job well at university”). The responses were collected on a Likert-type scale, whose scoring ranges ranged from 1 (It does not correspond at all) to 7 (It corresponds completely). A Cronbach's alpha of .63 was obtained.

Social competence. This instrument assesses the value perceived by the student about the teachings transmitted to them at the University and its importance in the future work context (e.g. "Understands the structure and functioning of my field of knowledge, in the different phases of development"). The sentence that precedes the 7 items that make up the scale is "What my teachers are teaching me allows me to be able to ...", and the answers vary from 1 (totally disagree) to 7 (totally agree). In this study, the internal consistency obtained was .90.

Study Processes. The Revised Study Process Questionnaire (R-CPE-2F), by Recio and Cabero (2005), in its Spanish version, was used. It is composed of 20 items with two categories of learning process: deep (DL) and superficial (SL), and a journey of 5 options, with four subscales: deep motivation (DM) (eg “Sometimes the study gives me a feeling of deep personal satisfaction ”), deep strategy (DS) (eg “I spend a large part of my free time gathering more

information on interesting topics already covered"), superficial motivation (SM) (eg "I don't find my course very interesting, that's why I work the least") and superficial strategy (SS) (eg "I can pass most exams by memorizing key parts of the topics, and not trying to understand them "). The Likert scale ranged from 1 (never or almost never true for me) to 5 (always or most of the time true for me). The items were preceded by the phrase "In my course ...". The internal consistency obtained was .78 for the deep student and .77 for the shallow one.

1.2.3. Process

To collect the information, in the first place, the study was presented and approved by the Ethics Committee of the institution of the responsible researcher (DPS.JMM.01.14). After previously informing the research objectives to the direction of the Academic Departments of the universities participating in the study, and having their support, we proceeded to contact the teachers involved to inform them of the objective of the research and request their collaboration. so that students could fill in the questionnaires. To ensure a greater number of participants, the questionnaires were administered during regularly scheduled practical classes, given their obligatory nature. The objective of the study and how to fill in the questionnaires were explained to the students in a generic way, solving any possible doubts that might arise during the process. They insisted on the willingness to participate and on anonymity so that they would answer honestly and sincerely. The time required to fill out the questionnaires was approximately 20 minutes. Participants provided their written informed consent to be part of the study.

1.2.4. Data análisis

Taking into account the nature of the problem and the endogenous variable to be estimated, it has been decided to use classification-based machine learning algorithms. The

prediction will be made based on certain explanatory variables, which will determine whether a student will pass or fail based on their values. Therefore, the predictions will be categorical, assigning a 0 to the failed students and 1 to the approved ones. Among the existing techniques in the literature that allow classifications of data sets, capable of determining which group will belong to each element, in this work the Random Forest algorithm will be used, which will analyze and determine the importance of each of the elements. the variables when classifying a student in a given group (Louppe, 2014).

The classification model was built using several different algorithms, each employing different classification techniques.

The Random Forest algorithm is based on the generation of decision trees, created randomly from a given data set. Each tree randomly chooses a set of data from the original datasheet, knowing this technique as “bootstrapping” (Efron, and Tibshirani, 1994). Each generated branch of the tree randomly chooses a subset of variables, forcing the tree to choose from these selected variables which ones take greater importance for the classification of each element. In this way, other variables are considered in the model, in addition to the most dominant ones, thus providing greater predictive power to the new data set. The final tree produces a classification response (class prediction) for each observation. This approach is then replicated for numerous trees, producing a forest. Once all the trees in the forest have been generated, the classification of each of them is analyzed, obtaining a classification of the input variable by majority vote. The importance of the predictor variables is also an important aspect in these techniques. The measurements that categorize these variables by their importance are: the measure of internal errors (tree nodes), the strength of the tree in the forest (classification

precision) and the correlation between the trees. In this way, a more precise classification is obtained than if we analyzed a tree independently (Breiman, 2001).

This technique must be fed with parameters that configure the internal operation of said algorithm. To do this, the optimal value of the number of trees was established through two metrics: the error ratio OOB (synthetic measure of the level of precision of the model) (Liaw and Wiener, 2002) and the precision of the prediction as a function of of the number of trees generated.

The unbalance in the classification, and therefore the obtaining of bad results, occurs when there is an underfitting or an overfitting. By training the model in order to fit the input data with each other and with the output, there is a risk that the model will generalize or adjust, above (overfitting) or below (underfitting), the knowledge that is intended that it acquires and therefore will not give good predictions. There is an underfitting when the algorithm is trained with very few elements and the machine is not able to generalize due to not having enough data. Overfitting occurs when training is given with samples with similar values and it is not able to recognize a new element because it does not coincide with the values of the initial samples. In neither case will the machine be able to achieve adjustment or generalization, since it will not be able to generalize the expected knowledge. Therefore, it is necessary to find a midpoint of adjustment by parameterizing and limiting the algorithm (Pothuganti, 2018). To improve the accuracy of the classification, and eliminate the effect of unbalanced training, several techniques were applied.

Also, in order to obtain a good classification, the importance of the variables involved in the model was determined. On the one hand, it was evaluated how relevant they are at the time of being used in the branches of each of the trees, and, on the other, their implication in

one or another classification, through the importance by permutation and the Lime. The permutation characteristic importance measure allows one to measure the increase in model prediction error after permuting the characteristic values, breaking the relationship between the characteristic and the actual result. A characteristic will be “important” if changing its values increases the error of the model, which implies that the model relied on that characteristic for the prediction; and it will be “not important” if by changing its values the error of the model does not change, which suggests that the model ignored the characteristic for the prediction. On the other hand, since many machine learning models are like 'black boxes' and it is not easy to know exactly why an algorithm, based on the input data, favors one or the other alternative through data from output, the LIME (Local Interpretable Model-Agnostic Explanations) is used, which focuses on training local surrogate models to explain individual predictions, giving interpretations of specific cases, instead of training a global surrogate model. These two resources make it possible to determine the importance of the variables involved in the model, insofar as their relevance is determined when used in the branches of the trees, and insofar as they are involved in one or the other classification. The data were analyzed using the SPSS 21.0 statistical package.

1.3 Results

1.3.1. Random forest classifier results

The first experiment carried out was based on the creation of the classification method itself, through the use of Random Forest (RF). The optimal value of the number of trees was established with the two metrics: the error ratio OOB (synthetic measure of the level of precision of the model) and the precision of the prediction as a function of the number of trees generated. Both in figure 1 and in figure 2 it is observed how, from 100 trees, the classification

generated is not greatly improved, therefore, to reduce the computation time obtaining good results, this parameter was set at 100 for the rest of the experiments. Regarding the rest of the possible parameters for the RF configuration (min_samples_leaf, n_jobs, random_state, etc), after several experiments, it was decided to leave them by default since it was not possible to improve the performance of the algorithm.

Figure 1. OOB error ratio as a function of the measure and the number of trees used.

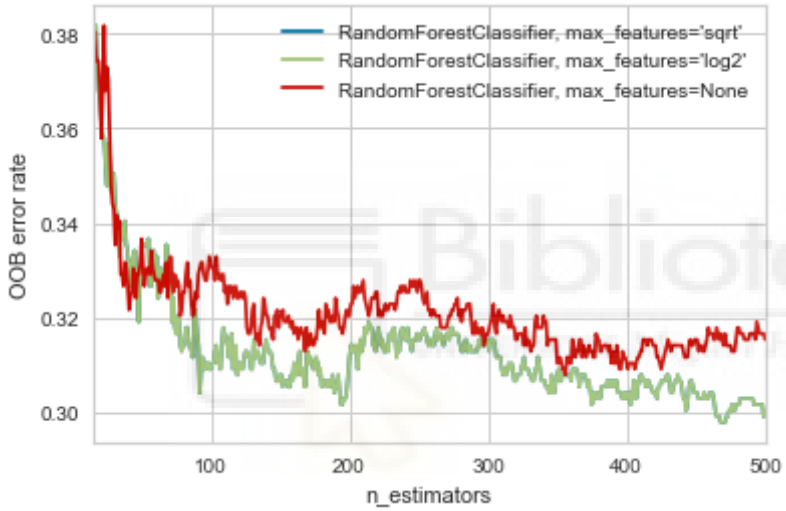
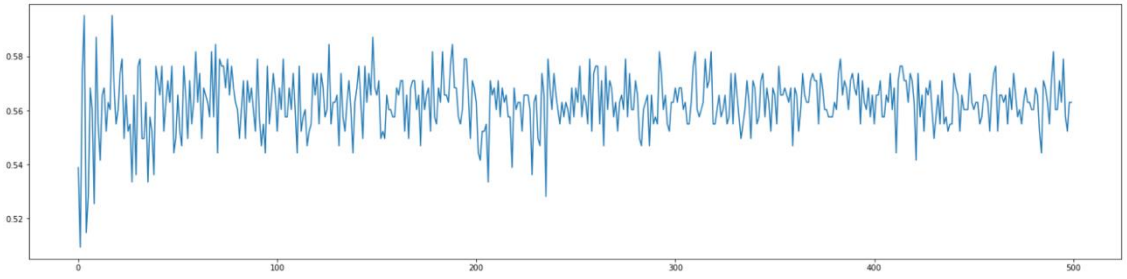


Figure 2. Accuracy obtained as a function of the number of trees generated.



As a final result, a classification of all the elements to be evaluated was obtained based on the relevance of each of the variables involved. A fragment of one of the trees is shown in Figure 3. As shown in Table 1, the model obtained, using various balancing techniques, allowed

68% of the cases to be correctly classified (accuracy level), obtaining a value of 60.05% for the *F1Score* metric.

Figure 3. Example of branches in the Random Forest classification process.

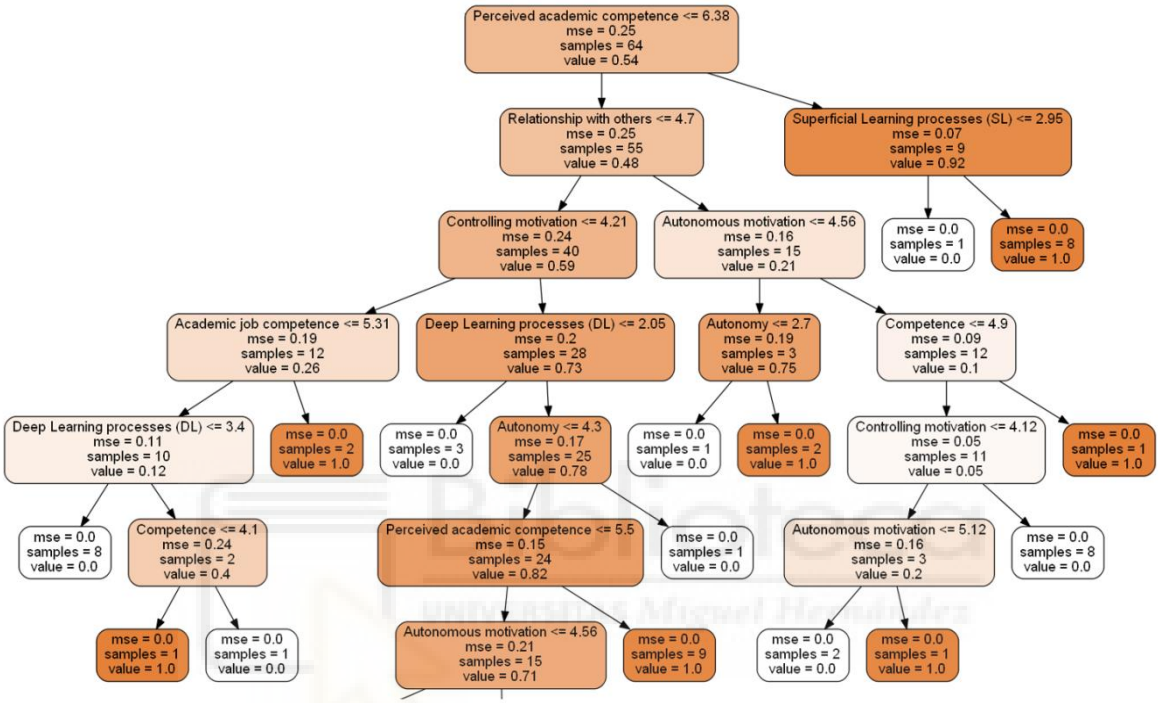


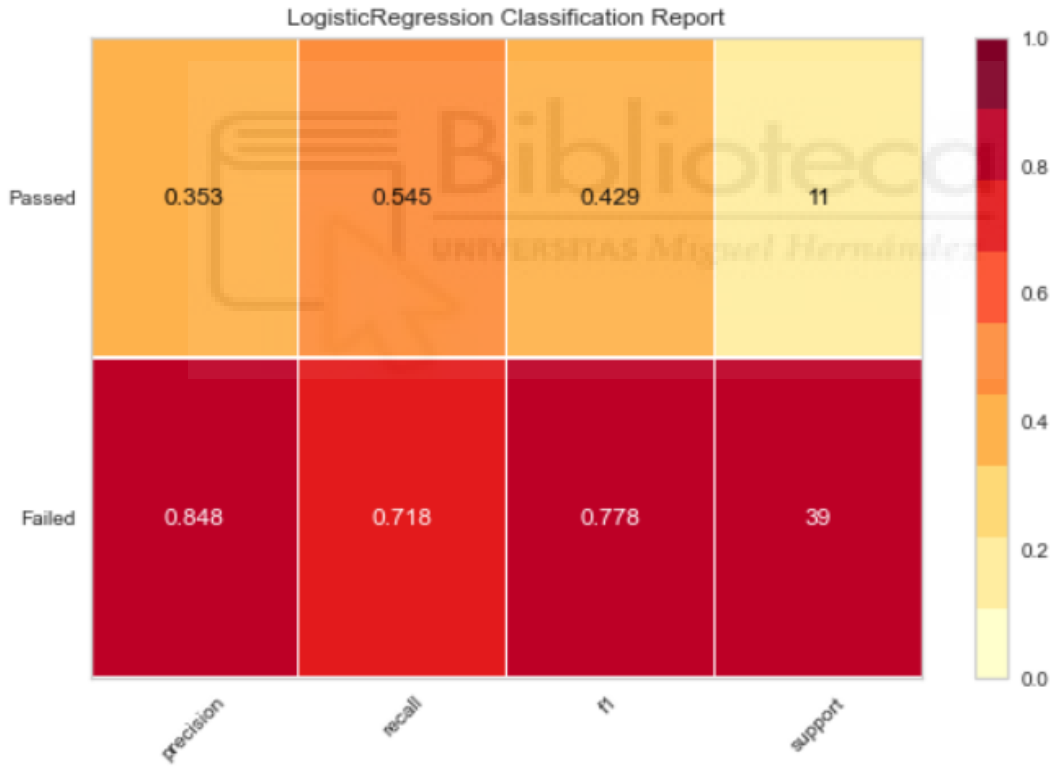
Table 1. Precisions of the classification that predicts academic success in students

	Clasification	precision	recall	f1	support	accuracy
BalancedBaggingClassifier	0	0,87	0,67	0,75	39	66%
	1	0,35	0,64	0,45	11	
LogisticRegression	**0**	**0,85**	**0,72**	**0,78**	**39**	**68%**
	1	**0,35**	**0,55**	**0,43**	**11**	
NearMiss	0	0,78	0,64	0,7	39	58%
	1	0,22	0,36	0,28	11	
RandomOverSampler	0	0,9	0,49	0,63	39	56%
	1	0,31	0,82	0,45	11	
SMOTETomek	0	0,91	0,54	0,68	39	60%
	1	0,33	0,82	0,47	11	

1.3.2. Balance of fit

In order to improve the precision in the classification obtained, the training set was evaluated to avoid overfitting and to check whether or not the data set was balanced in terms of the samples used. It was observed that in the training set of 799 elements, 539 are passed students while 260 are failed. The results for this raw set, in terms of precision (recision), sensitivity (recall), and harmonic average (f1) are presented in Figure 4.

Figure 4. Precision and sensitivity measurements with the original training set.



1.3.2. Permutation characteristic and the LIME

To evaluate the relevance of the variables, the measure of importance of the permutation characteristic and the Lime, allowed obtaining results in which the most important

variables are observed in the model, given their relevance as they are present in the branches and as soon as they are present. in one or another classification (Figure 5).

As shown in figures 5 and 6, All the variables that appear in the classification are present in all students; however, from the analyzes, it was possible to identify that the students of deep study processes presented a self-determined motivational profile, composed of greater satisfaction of the BPN, in the dimensions of competence and relationship with others, greater motivation autonomous, as well as, and, greater academic competence.

Figure 5. Importance of the variables generated by Lime

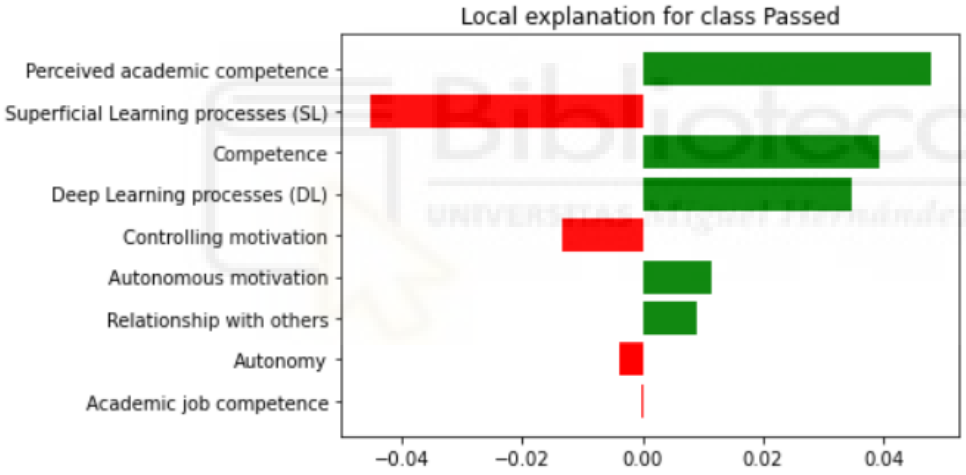
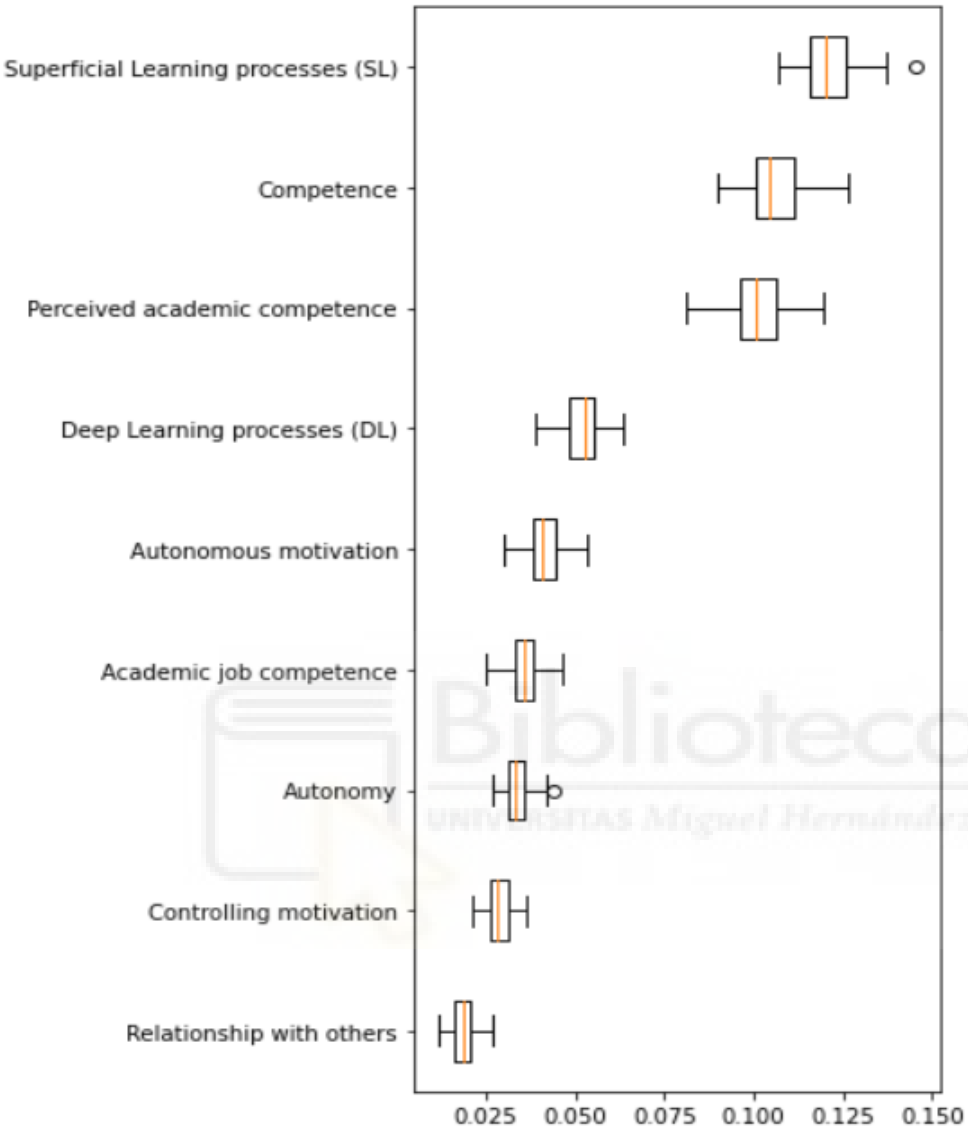


Figure 6. Importance of the variables generated by permutation



1.4 Discussion

The objective of this study was to predict the academic success of higher education students from the variables proposed by the Random Forest algorithm based on the theoretical framework of the SDT for the teaching-learning scenario in the context of higher education: basic psychological needs, academic motivation, learning process, and perceived academic and social competence.

Regarding the main objective of the study, it was possible to build a model with the random forest algorithm to predict academic success in university students. Specifically, the students who were successful in their academic process were those who perceived their BPN to be satisfied, presented greater academic motivation of a self-determined nature, a deep learning process and a greater perception of academic competence.

The factor that most influenced the academic success of the students was the satisfaction of the need for competence, followed by the deep learning process and the perception of academic competence.

Indeed, in line with the SDT, previous works have indicated that self-determined motivation is associated with greater involvement of students in their study processes (Badiozaman, Leong, Jikus, 2019) and in turn with higher performance (Jang, Reeve , & Halusic, 2016). This profile of students with an in-depth study approach is also characterized by presenting greater academic competence and greater satisfaction with the BPNs. In this sense, satisfying the need for competence promotes greater effort in performing tasks by improving the perceived effectiveness when the student feels capable of managing their own learning process (Meng and Ma, 2015). In this line, previous works have shown that the satisfaction of the need for relationship with others is positively associated with the academic commitment of students by solidifying the quality of social ties between them (Fong, Dillard, & Hatcher, 2019; Vermote, Aelterman, Beyers, Aper, Buysschaert, & Vansteenkiste, 2020). Regarding the need for autonomy, the results suggest that higher education students were not satisfied with this mediator, contrary to what was predicted according to the SDT framework. Some studies have yielded data in this sense regarding the lower satisfaction of BPN as one advances in the educational level (Gómez-Rijo, Hernández, Martínez y Gámez, 2014), an aspect that should

serve to reflect on the importance of designing strategies motivational teachers that place the interests and preferences of the student as a key aspect to take into account in the instructional process.

These findings confirm the SDT approach, insofar as self-determined motivational processes are one of the key components for academic success (Nonaillada, 2019). Furthermore, in this study, the analysis approach based on the random forest algorithm represents a first approach to this line of research (Yu et al., 2020) compared to previous studies. In this sense, until now, studies based on SDT, in higher education settings and focused on academic performance, have been designed from correlational studies (Bronson, 2016; Depasque, and Tricomi, 2015; Khalaila, 2014; Leenknecht et al., 2017; Martinek, Zumbach, and Carmignola, 2020; Orsini, Binnie, and Tricio, 2018); linear regression analysis (Cortez, Winer, Kim, Hanseman, Athota, and Quillin, 2019; Griffin, 2016); of structural equation models (Froiland, and Worrell, 2016; Haerens, Aelterman, Vansteenkiste, Soenens, and Van Petegem, 2015; Kingsford-Smith, and Evans, 2019; Wang, Hefetz, and Liberman, 2017); experimental designs (Meng, and Ma, 2015; Weidinger, Spinath, and Steinmayr, 2016: Zamzami, and Corinne, 2019) and meta-analysis (Taylor et al., 2014). The present study, in this sense, represents a first approach to the analyzes supported by machine learning with the random forest algorithm using the theoretical framework of the SDT.

However, this work has some limitations. The algorithm shown is the product of repeated model interactions, and its metrics were not yet efficient enough. It would be necessary to create a higher quality procedure from a larger number of data that improves the quality of the model construction. Furthermore, given the limitations of a cross-sectional study, longitudinal

studies should be designed to help understand the evolution of these motivational variables as a function of degree, gender or age.

As practical implications, the real implementation of these models would allow the development of projects focused on the prevention of dropout in higher education by promoting motivational teaching strategies that focus on the deep learning processes of students by satisfying psychological needs basic. In addition, more training would be necessary for higher education teachers on motivational strategies that have shown scientific evidence to promote satisfaction with BPN and improve student motivation. Ability to choose to promote autonomy, explanation of objectives, clarity of expectations, positive and informative feedback to promote competition, and promote flexible groupings to promote quality social ties, would be some of the fundamental elements for manage to promote quality motivation, and a better perception of competence that guarantees the academic success of students.

1.5 Conclusions

This study, from the framework of the SDT, confirms the importance of satisfying the BPN and promoting autonomous motivation in the student in the search for academic success. In addition, it confirms the importance of the deep learning process for this result, which is why it is presented as an aspect to be valued in the first educational levels. Finally, the use of the random forest algorithm in this study, in addition to allowing the corroboration of the findings described, is presented as a valuable alternative to handle large amounts of data and carry out robust and reliable analyzes.

1.6 References

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