

The effects of teamwork on critical thinking: A serial mediation analysis of the influence of work skills and educational motivation in secondary school students

Clemente Rodríguez-Sabiote, Eva María Olmedo-Moreno and Jorge Expósito-López

Universidad de Granada

Abstract

Social and educational realities require formative systems to be established that develop skills in students such as teamwork, critical thinking and motivational processes. These serve as basic elements that permit effective social and occupational integration. The present study proposed to establish an explanatory theoretical model and sought to compare a serial mediational model containing two variables in order to associate these variables in secondary school students. The present study also sought to analyse the direct and indirect relationships and effects produced between the variables that made up the specified model. The research design was *ex post facto* and cross-sectional. A quantitative methodology was applied, taking a single measurement from a sample of 1159 participating secondary school students from Spain.

Outcomes provide evidence that greater teamwork is related with better developed critical thinking skills. Further, greater teamwork and higher degrees of motivation increased critical thinking, whilst better conceptions of teamwork impacted upon better future work skills. Resultantly, these outcomes imply better educational motivation and higher levels of critical thinking.

Another relevant finding was the determination of the importance of mediational effects. In this regard, outcomes pertaining to teamwork were mediated by work skills and, above all, educational motivation, with mediational effects also existing in relation to critical thinking. The sequential mediation of teamwork by work skills and educational motivation was found to be less relevant, although this finding was also statistically significant and should be held in mind.

Keywords: Teamwork; critical thinking; motivation; future work skills; PROCESS

Introduction

The transformation of social relationships and the emergence of digital settings have determined new ways of acting in society and new training needs in this regard. Social and occupational settings determine what students must learn. They dictate the strategies to be employed and the different skills to be put into action, calling on, for example, greater self-motivation, autonomy, self-regulation and effective independent learning (Schunk & Zimmerman, 2007; Zimmerman, 2008; Suárez, et al. 2016; Fraile, et al, 2020), the capacity to work in multidisciplinary teams (Maxwell, 2008; Acosta, 2011; Davies et al., 2011; Hebles et al., 2019) and critical thinking (Huber, 2020). These skills converge so that individuals are able to achieve sufficient skills to equip them as future workers (Davies, Fidler, & Gorbis, 2011).

The main aspect considered in the present study refers to the skills relevant for a future worker and their teamwork capacity. These make up the basic abilities considered relevant to what some authors denominate the industrial revolution 4.0 (Mahou & Díaz, 2018; Sukhodolov, 2019), possessing a huge impact within organisations and on the possibility to quickly, creatively and innovatively resolve issues.

Teamwork capacity implies that individuals are able to integrate themselves and interact with others in educational and occupational processes with shared goals (González & Wagenaar, 2003; Barraycoa & Lasaga, 2010; Atxurra & Villardón-Gallego, 2015). It is made up of different components such as identity and belonging to a collective or group, the interaction between members and the execution of plans to achieve goals. Thus, as proposed by Barraycoa & Lasaga (2010), this capacity can be improved by working on empathy, communication, time management or decision making. It is a basic capacity that should be worked on with students (Franco & Velásquez-Vásquez, 2000) as an element to be developed in the individual at the present time and in the future professional (Acosta, 2011). This work enables the preparation of individuals so that they can actively participate in the digital and knowledge society (González & Wagenaar, 2003, 2008). Similarly, the H2030 agenda for sustainable development considers teamwork capacity as a key element in the transformation of secondary school and vocational training studies in Spain (Ministry of Education and Vocational Training, 2019) and in Europe (European Union Council, 2018). This ability is associated with innovation and entrepreneurship, with these being eminently human qualities and drivers of social development and economic growth.

Teamwork capacity is modified by, amongst other things, motivation. This is an inherent and recurring construct in educational processes in both educational and professional fields (Hayenga, & Corpus, 2010). It serves to explain the energy that impels individuals to perform a task and sustain this over time (Ryan, & Deci, 2020). Consideration of motivation with improve the learning process itself, strengthen teaching practice and prevent academic dropout (Núñez et al., 2010; Ryan & Deci, 2016; Patall et al., 2018 & Diseth et al., 2020). It depends on the judgements students make about the teaching process itself, in addition to whether content and teaching methods meet their needs, interests and goals (Tsyganova, et al., 2020).

The two main theories employed to explain motivation are self-determination theory (SDT, from hereon) and the motivational self system (Takahashi et al., 2020). The SDT defines motivation as, “an understanding of human motivation requires a consideration of innate psychological needs for competence, autonomy, and relatedness” (Deci & Ryan, 2000, p.277). In other words, needs are satisfied when students make their own decisions, with this influencing positively their wellbeing and, therefore, their learning, whilst also leading them to be more open to new learning approaches (Virkkula, 2020). In this way, motivation is a multidimensional construct which can be regulated in different ways (Ntoumanis, et al., 2020; Ryan & Deci, 2017; Karlen, et al., 2019). Motivational regulation is established along a continuum (Ryan & Deci, 2020) which ranges from higher to lower levels of self-determination, with this being characterised by different levels of internal and external regulation (Gillet et al., 2012; Núñez et al., 2005; Pelletier et al., 2013). Adams et al. (2017) have stated that this theory is composed by six “mini-theories”, with these referring to the multiple realities that influence individual motivations, cognitive evaluation, rewards and feedback, goal orientations, causality, and basic psychological needs.

Thus, it is crucial to identify the type and level student motivation and the factors that may influence its development. Namely, these factors include autonomy, social support,

teacher leadership, classroom methodology and use of materials, amongst others (Núñez et al., 2010; Utvær, & Haugan, 2016). These factors favour aspects that promote more self-determined student motivations (Hayenga & Corpus, 2010; Ryan & Deci, 2020). Recent studies, such as that described by Patall et al. (2018), highlight the need to examine motivation from a self-determination perspective as a mediator of the development of learning and the improvement of skills required by workers and citizens of the future. The other modifying component refers to the development of future work skills as a basic element that is not only predictive of the potential for future integration in the world of work (Davies, Fidler, & Gorbis, 2011) but, also, potential for present development of students in formative processes (Honicke & Broadbent, 2016) linked with self-efficacy. Self-efficacy is one of the main elements of Bandura's Social Cognitive Theory (1977, 1999, 2001). It refers to the capacity of individuals to regulate and organise their actions using their personal judgement. From an educational viewpoint, academic self-efficacy is linked with greater academic effort and performance, with the maintenance of good levels of self-efficacy being essential to ensuring success in teaching-learning processes (Putwain, Sander, & Larkin, 2013; Esmaceli, Sohrabi, Mehryar, & Khayer, 2019). Examination of self-efficacy is, therefore, of great interest because it has enabled it to be linked with task understanding, trust and effort (Galleguillos-Herrera & Olmedo, 2017 y 2019).

All of these components come together in the generation of critical capacity. This is a trait that contemporary democratic societies demand in their citizens, with critical thinking being a key element in the development of educational contexts pertaining to secondary school and initial vocational training (Rönnlund, Ledman, Nylund & Rosvall, 2019). It can be considered as a basic skill which is key to designing not only individual critical capacity but, also, academic and vocational capacities. For this reason, it does not make any sense to separate all of these elements but, instead, to consider them as facets of the same educational outcome.

The direct link of the development of critical thinking with effective knowledge management appears to be evident. However, in addition, the development of critical thinking enables organisational strategies to be generated. These, at the same time, provide a key element in cognitive and meta-cognitive development and, therefore, facilitate better personal cognitive development and the development of higher order thinking abilities (Nussbaum, 2012).

Although critical thinking appears to be a basic requirement for all students at certain educational stages, such as university education, the complexity of its development requires addressing from early educational stages (Van der Zandem, 2020). It must be confirmed as a basic requirement for the development and progress of individuals at any educational level and, therefore, as a basic outcome of the training processes developed by teachers (Martínez, Ballester & Ibarra, 2019).

Expósito, Romero, Olmos, Chacón, & Olmedo (2019) place special emphasis on the importance of future work skills at different levels of the educational system as a key element of the success of training processes and the reach of future potential. Given that all of these variables constitute components of complex psychological and educational constructs, studies need to be conducted that demonstrate links and inter-relationships in such a way that appropriate training processes can be designed.

Thus, the present study seeks to establish the effect of teamwork on critical thinking via a multiple serial mediation analysis of work skills and educational motivation in secondary students. Analysis will enable relationships to be established between the variables conceptualised and described above in the introduction.

Aim and research hypotheses

The present research was carried out with a view to addressing two basic research aims: (a) define an explanatory theoretical model and develop a multiple mediational model with two variables, examined in series, in order to relate educational motivation, teamwork, future work skills and critical thinking in students undertaking compulsory secondary education; and (b) analyse direct and indirect relationships and effects pertaining to the variables that make up the aforementioned model.

Similarly, the following hypotheses pertaining to the mediation analysis were formulated for the present study:

- Hypothesis 1: Greater teamwork, together with future work skills, increase critical thinking: $\text{Ind1} = \text{Twork} \rightarrow \text{WSk} \rightarrow \text{CThink}$.
- Hypothesis 2: Greater teamwork, together with a higher degree of educational motivation, increase critical thinking: $\text{Ind2} = \text{Twork} \rightarrow \text{EdMot} \rightarrow \text{CThink}$.
- Hypothesis 3: Greater conceptions of teamwork will lead to greater future work skills which, consequently, will also imply greater educational motivation and critical thinking: $\text{Ind3} = \text{Twork} \rightarrow \text{WSk} \rightarrow \text{EdMot} \rightarrow \text{CThink}$.

Material and methods

Design and sample

The present study followed an *ex post facto* and cross-sectional design, employing a quantitative methodology which applied one single measurement. The population pertained to secondary school students (Spain), focusing on a key training stage for the basic development of students given that, at this stage (baccalaureate and training cycles), young people face hugely important transitional stages which oblige them to constantly make decisions (Álvarez-Justel & Ruiz-Bueno, 2021). Although the sample was selected intentionally, pseudorandom criteria were established by Merino et al. (2015) for natural groups were applied. Selection criteria included having to be registered for at least 60% of in-person course modules and regularly attending classes. Participants were excluded if they had any issues that impeded correct questionnaire completion.

The experimental sample was composed of a total of 1159 participants, with a mean age of 20.57 years (standard deviation = 6.75). The sample was made up of 44.6% (n=517) males and 55.4% (n=642) females who were undertaking vocational training (76.3%, n=884) or baccalaureate studies (23.7%, n=275).

Instruments

Collection of the data required to address the proposed research hypotheses and consider the study variables called for the use of the followed different instruments:

1. Motivation: The original educational motivation scale (EME) validated by Núñez et al. (2005) for use in the university context was employed. This scale was later adapted by Núñez et al. (2010) to the secondary school context. This questionnaire comprises 28 items which are distributed according to 7 dimensions (e.g., “5. I honestly do not know, I think I am wasting time at school”). Items are responded to along a 7-point Likert scale (1 = does not correspond to me at all; 7 = totally corresponds to me). However, the present study employed a shortened version which has been adapted for use with secondary school students in the Spanish context. As described by Expósito et al. (2021), items are distributed according to 4 dimensions: Intrinsic motivation (2, 3, 7, 11, 15 and 16), internally regulated

- extrinsic motivation (5, 6, 9, 13, 18 and 19), externally regulated extrinsic motivation (1, 10 and 14) and amotivation (4, 8, 12 and 17).
2. Teamwork skills: The teamwork scale (ETE) (Lower et al., 2017) comprises 9 items, all of which pertain to a single dimension (e.g., 1. I believe that teamwork is important) and are rated along a Likert scale with five response options (1 = not at all true; 5 = really true). In the present study, a version adapted for use with secondary school students in the Spanish context was employed (Romero-Díaz de la Guardia et al., 2022). This tool comprises the following three factors: Teamwork ratings (1 and 2), perceptions of teamwork (3 and 10) and attitudes towards teamwork (5, 6, 7, 8 and 9).
 3. Future work skills: The future work skills scale (SFWS-H2030) was established under premises defined by Davies et al. (2011) and adapted to the Spanish context by Expósito et al. (2019). The scale comprises 10 items which pertain to 10 basic abilities for insertion into the future workforce. Items are grouped into 4 categories corresponding to a total of 20 descriptors.
 4. Critical thinking: The critical thinking questionnaire (Sosu, 2013) is composed of 11 items (e.g., 2. I often use new ideas to modify or give shape to the things I do). Items are responded to on a 5-point Likert scale, where 1 is “totally disagree” and 5 is “totally agree”. This questionnaire groups items into two factors: Reflective critical thinking (1, 6, 7, 8, 9, 10 and 11) and executive critical thinking (2, 3, 4 and 5).

Instruments were administered in person and in paper format. In addition to the student’s tutor, a researcher associated with the project was present at all times in order to ensure correct completion of items. It serves to indicate that this process occurred without notable incidents and that, finally, all questionnaires that had been incorrectly completed (incomplete or blank responses, confusing responses, etc.) were eliminated from the study. In this regard, it serves to indicate that the present research respected students’ rights to confidentiality, in addition to the ethical research norms established by the Declaration of Helsinki (1975) and later update in Brazil (2013). Further, the project obtained approval from the Ethical Committee of the University of Granada (reference number: 1678/CEIH/2020).

Reliability and validity of the data collection instruments used in the present study

The different scales employed in the present study were duly standardised and the psychometric properties (reliability, internal consistency, and criterion and construct validity) of the compulsory items well-supported, as previously explained in an earlier section (the section pertaining to instruments). Nonetheless, here, outcomes obtained for the different administered scales are presented with regards to reliability and internal consistency (a single administration), in addition to concurrent criterion validity in the specific context of the present study. For both reliability and internal consistency, Cronbach α and McDonald’s ω coefficients were calculated. For concurrent criterion validity, the corrected item-total correlation was calculated. Outcomes pertaining to both aspects are presented and commented on next:

Table. 1. Scales reliability statistics.

Scales	Cronbach's α	McDonald's ω
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SFWS-H2030	0.621	0.629
CTQ	0.740	0.752
TWS	0.749	0.796
EMS	0.878	0.903

Source: Elaborated by the authors

With regards to Cronbach α and McDonald's ω reliability coefficients, obtained outcomes are revealing, demonstrating moderate internal consistency of the evaluated scales (McDonald, 1999; Katz, 2006). Specifically, the SFWS-H2030 (future work skills scale) achieved a Cronbach α coefficient of 0.621 and a McDonald's ω coefficient of 0.629. Values for the CTQ (critical thinking questionnaire) were Cronbach α = 0.74 and McDonald's ω =0.752, whilst values for the TWS (teamwork scale) were Cronbach α = 0.749 and McDonald's ω =0.796. Finally, the EMS (educational motivation scale) obtained the highest internal consistency values, with a Cronbach α of 0.878 and a McDonald's ω of 0.903. From this it can be surmised, in general, that moderately high Cronbach α and McDonald's ω values emerged, suggested good internal consistency (Zumbo, Gadermann & Zeisser, 2007). Outcomes were less strong in the case of the SFWS-H2030, potentially due, in part, to the fact that the response rate was lower for this scale than for the other scales. This aspect tends to act unfavourably on reliability outcomes (Cummins & Gullone, 2000; Dillman, 2007 and Matas, 2018) and could explain why the minimum value of 0.70 required to demonstrate reliability was not reached in the case of the SFWS-H2030.

Finally, with regards to criterion validity, the item-total or item-score correlation was calculated, in other words, the correlation found between each separate item and the overall score for the scale to which it belongs. In the majority of cases, $r > .35$ was obtained. This indicates that the majority of the items belonging to the four examined data collection instruments individually measure the same concept at the overall scale to which they belong (internal criterion).

Data analysis

The tested model pertains to that denominated model 6 by Hayes (2013). This model is a mediation model in which a criterion or dependent variable is found (Y = critical thinking [Cthink]), alongside a predictor or independent variable (X = teamwork [Twork]) and two sequential mediators, or causal chain mediation (in serial) (namely, M_1 = work skills [Wsk] and M_2 = educational motivation [EdMot]). Conceptually, this type of model is denominated a multiple mediational model with two sequential variables. Graphically, the model can be represented through two different diagrams, although, in reality, they correspond to the same approximation. On the one hand, the conceptual diagram is found in which the four variables included in the model are represented as X , M_1 , M_2 and Y . On the other hand, the statistical diagram represents, in addition to the aforementioned variables, all of the regression coefficients (β), or standardised or unstandardised slopes corresponding to the regression equations that make up the model. In the present case, 5 regression equations would be found (including the overall effect) according to their regression coefficients which are indicated by the following letters: a_1 , a_2 , b_1 , b_2 , d_{21} , c and c' . Further, the various error terms (e_n) associated with the different regression coefficients are presented, for both the intercepts or constants (α) and the slopes (β).

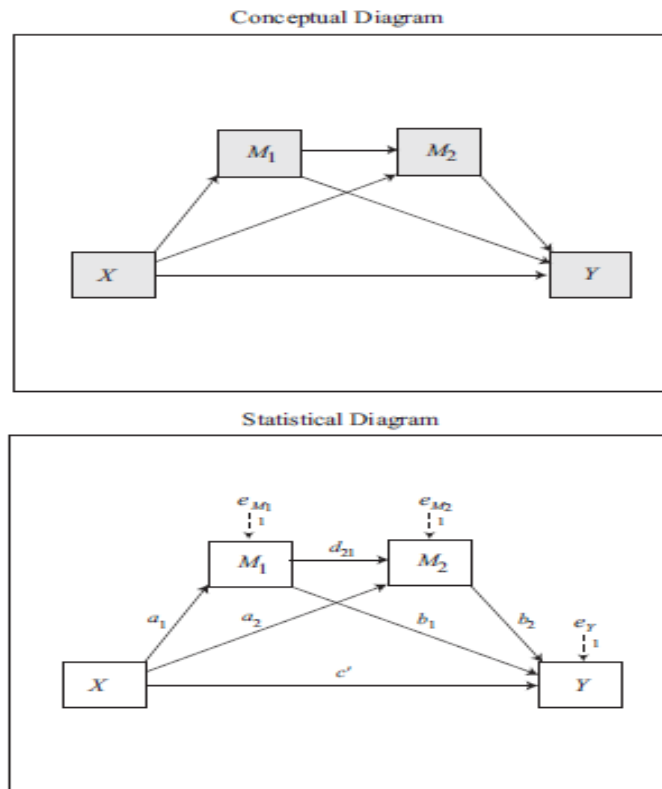


Figure 1. Model 6. Conceptual and statistical diagrams.

Source: Elaborated by Hayes (2018).

The program PROCESS in SPSS was used to examine the mediational hypothesis proposed in the present study (v.3.5.3, Hayes, 2018). Bootstrapping was applied. This strategy considerably reduces bias derived from the failure to meet parametric norms, particularly those relating to normality and the bias caused by small sample sizes (although this was not the case in the present study). Thus, the statistical approach can be considered to provide more robust estimates (Rockwood & Hayes, 2020). The bootstrapping method is based on repeated and random sampling from the overall dataset as a way of estimating the desired statistic in each repeated round of sampling. The main advantage of this when compared to the initial method of sequential steps proposed by Baron & Kenny (1986) and the Sobel test (Preacher & Hayes, 2004), is that it is capable of providing specific estimates and confidence intervals through which it can be evaluated whether mediation effects are statistically significant or not (Hayes, 2009).

Results

Prior to examining the proposed mediational model, the various correlations between and within the 4 variables making up the model were estimated. In other words, the bivariate correlation matrix was estimated according to Pearson correlation coefficients, highlighting in blue all correlations relating the variable critical thinking with teamwork (predictor – x –), work skills (mediator 1 – M_1 –) and educational motivation (mediator 2– M_2 –). All remaining correlations were highlighted in red. In this regard, outcomes calculated via the program JAMOVI (The jamovi project, Sydney, Australia) were as follows:

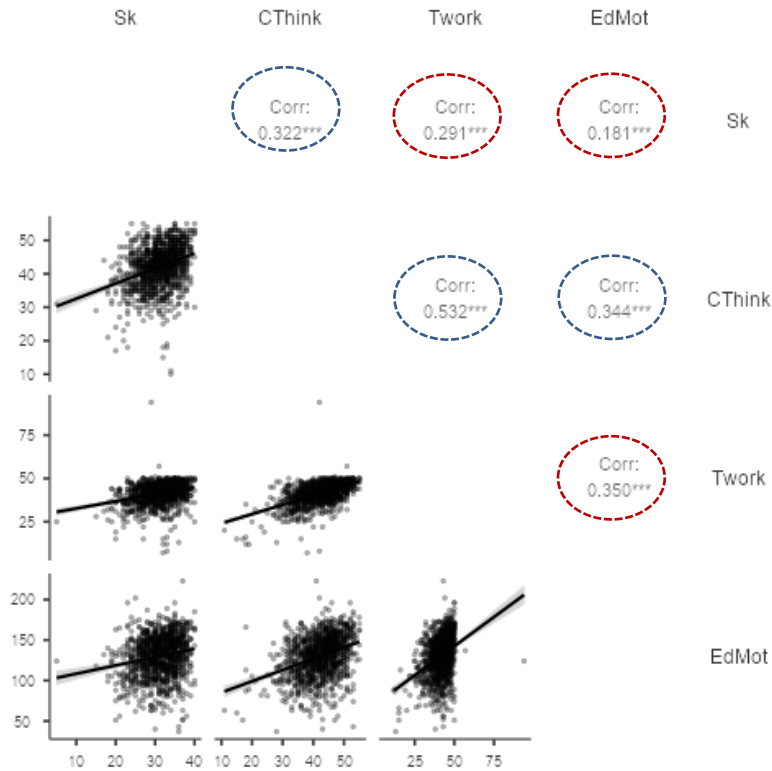


Figure 2. Correlation matrix.

Source: Elaborated by the authors

The mediational model focuses its interest only on correlations 1,4 and 5, although it can also be seen that correlations with all other variables emerged as positive and statistically significant ($p < .001$). Turning interest back to the proposed object of study, specifically, those correlations indicated in blue, it can be observed that the variable critical thinking is positively and significantly correlated with the teamwork variable, which acts as a predictor ($r = .532$, $p < .001$), in addition to both mediator 1 ‘work skills’ ($r = .322$, $p < .001$) and mediator 2 ‘educational motivation’ ($r = .344$, $p < .001$). These outcomes provide enough support for further examination of the proposed mediational hypotheses. Well-founded arguments exist to be able to predict critical thinking from perceptions of teamwork, however, it can also be observed that both work skills and educational motivation also play an important role in this sense. For this reason, it was of interest to determine the strength of the mediational relationship for predicting this outcome. Thus, following implementation of different analytical procedures through PROCESS, outcomes obtained are presented, firstly, in relation to the different regression analyses conducted, followed by total effects model, and the total and direct effects of x on y . All were produced by employing procedure pertaining to model 6, as described above.

Table 1. Regression analysis and total and direct effects of X on Y .

Outcome variable: Work skills (WSk)						
Model summary						
R	R-sq	MSE	F	df1	df2	p
.3013	.0908	18.2067	114.8818	1	1151	.000***
Model	Coeff.	Se	t	p	LLCI	ULCI
constant	22.0181	.8562	25.7168	.000***	20.3382	23.6979

Twork .2195 .0205 10.7183 .000*** .1793 .2596
 Regression analysis 1: $X \rightarrow M_1$ (coeff. a_1) $Y = \alpha + \beta_1(a_1) / WSk = 22.01 + .21_{Twork}$

Outcome variable: Educational motivation (EdMot)

Model summary

R	R-sq	MSE	F	df1	df2	p
.3586	.1286	558.0266	84.8565	2	1150	.000***
Model	Coeff	Se	t	p	LLCI	ULCI
constant	60.0960	5.9478	10.1039	.000***		
Twork	1.3371	.1189	11.2483	.000***		
Wsk	.4696	.1632	2.8780	.0041**		

Regression analysis 2: $M_1, X \rightarrow M_2$ (coeff. d_{21}, a_2) $Y = \alpha + \beta_1(d_{12}) + \beta_2(a_2) / EdMot = 60.09 + .46_{Wsk} + 1.33_{Twork}$

Outcome variable: Critical thinking (Cthink)

Model summary

R	R-sq	MSE	F	df1	df2	p
.5887	.3465	25.4839	203.0922	3	1149	.000***
Model	Coeff	Se	t	p	LLCI	ULCI
constant	11.4287	1.3265	8.6172	.000***	8.8265	14.0309
Twork	.4424	.0268	16.5307	.000***	.3899	.4949
Wsk	.2329	.0350	6.6561	.000***	.1643	.3016
EdNot	.0398	.0063	6.3202	.000***	.0275	.0522

Regression analysis 3: $M_1, M_2, X \rightarrow Y$ (coefficients b_1, b_2, c')

$Y = \alpha + \beta_1(b_1) + \beta_2(b_2) + \beta_3(c') / Cthink = 11.42 + .03_{EdMot} + .23_{Wsk} + .44_{Twork}$

TOTAL EFFECT MODEL

Outcome variable: Critical thinking (CThink)

Model summary

R	R-sq	MSE	F	df1	df2	p
.5424	.2942	27.4770	479.7348	1	1151	.000***
Model	Coeff.	Se	t	p	LLCI	ULCI
constant	19.3631	1.0518	18.4095	.000***	17.2994	21.4267
Twork	.5509	.0252	21.9028	.000***	.5016	.6003

Regression analysis 1: $X \rightarrow Y$ (coeff. c) $Y = \alpha + \beta_1(c) / Cthink = 19.36 + .55_{Twork}$

TOTAL AND DIRECT EFFECT OF X ON Y

Total effect of X on Y

Effect	Se	t	p	LLCI	ULCI	c_ps	c_cs
.5509	.0252	21.9028	.000***	.5016	.6003	.0883	.5424

Direct effect of X on Y

Effect	Se	t	p	LLCI	ULCI	c_ps	c_cs
.4424	.0268	16.5307	.000***	.3899	.4949	.0709	.4356

* $p < .05$ ** $p < .01$ *** $p < .001$.

Level of confidence for all confidence intervals in output: 95%

Number of bootstrap samples for percentile bootstrap confidence intervals: 10000.

Source: Elaborated by the authors

Following examination of data via the program PROCESS, outcomes can be observed, firstly, in relation to the different regression equations statistically sustained by model 6. In this sense, it can be seen that, in the first regression analysis (1: $X \rightarrow M_1$ (coeff. a_1) $Y = \alpha + \beta_1(a_1)$), the variable $X = \text{Teamwork}$ acted as the sole predictor of mediator 1 (work skills). This produced the following regression equation: $Wsk = 22.01 + .21_{Twork}$. The $\beta_1(a_1)$ coefficient was equal to .21, with this being statistically significant ($p < .001$). With regards to the second regression analysis (2: $M_1, X \rightarrow M_2$ (coeff. d_{21}, a_2) $Y = \alpha + \beta_1(d_{12}) + \beta_2(a_2)$), both mediator 1 (work skills) and the main predictor (teamwork) acted as predictors of moderator 2 (motivational education). This produced the following regression equation: $EduMot = 60.09 + .46_{Wsk} + 1.33_{Twork}$. As was the case with regression analysis 1, both the $\beta_1(d_{12})$ coefficient was equal to .46 ($p < .01$) and the $\beta_2(a_2)$ coefficient was equal to 1.33 ($p < .001$), with both of these also being statistically significant. With

regards to regression analysis 3 (3: $M_1, M_2, X \rightarrow Y$ (coeff. b_1, b_2, c') $Y = \alpha + \beta_1 (b_1) + \beta_2 (b_2) + \beta_3 (c')$), both mediating variables (educational motivation and work skills), together with the main predictor (teamwork) acted as predictors of the criterion or dependent variable (critical thinking). The resulting regression equation was as follows: $Cthink = 11.42 + .03EdMot + .23Wsk + .44Twork$. In a similar way to that seen with the two prior regressions, the $\beta_1 (b_1)$ coefficient was equal to $.03 (p < .001)$, the $\beta_2 (b_2)$ coefficient equalled $.23 (p < .001)$ and the $\beta_3 (c')$ coefficient was equal to $.44 (p < .001)$, with all of these being statistically significant. These outcomes appear to empirically confirm that the main predictor (teamwork) and its mediators (work skills and educational motivation) can be included as variables which may help to predict critical thinking. Finally, it can be observed that both the total effect ($\beta (c) = .55 (p < .001)$) and direct effect ($\beta (c') = .44 (p < .001)$) were also statistically significant. A diagram of the produced model is presented below.

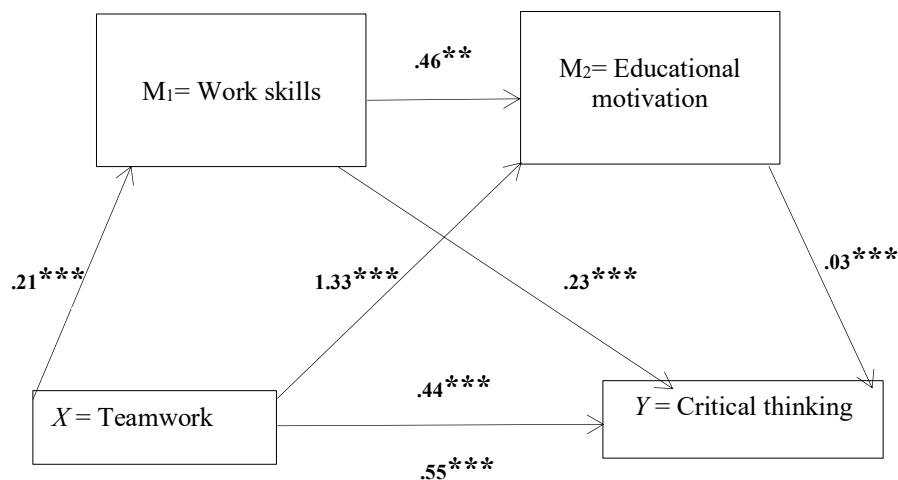


Figure 3. Model diagram.

* $p < .05$ ** $p < .01$ *** $p < .001$.

Source: Elaborated by the authors

Secondly, and most importantly for a mediational model, outcomes pertaining to indirect effects are presented, alongside comparisons of these effects according to binomial groups. This part of the analysis serves to confirm that, in addition to the principal predictor under consideration (teamwork), a mediating role may exist for work skills and educational motivation which is driven by the presence of lower or higher degrees of critical thinking. Outcomes pertaining to the indirect effects are as follows:

Table 2. Completely standardised indirect effect(s) of X on Y.

Type of effect	Effect	Boot SE	Boot LLCI	Boot ULCI
Total	.1068	.0145	.0785	.1354
Ind ₁	.0503	.0104	.0312	.0717
Ind ₂	.0524	.0109	.0318	.0747
Ind ₃	.0040	.0018	.0010	.0079
Specific indirect effect contrast definition(s):				
C ₁ (Ind ₁ vs Ind ₂)	-.0021	.0161	-.0338	.0296
C ₂ (Ind ₁ vs Ind ₃)	.0463	.0103	.0272	.0674
C ₃ (Ind ₂ vs Ind ₃)	.0484	.0106	.0286	.0705

Indirect effect key:
Ind1 Twork→WSk → CThink
Ind2 Twork→EdMot→CThink
Ind3 Twork→WSk→ EdMot→CThink

Source: Elaborated by the authors

With regards to the first indirect effect ($[a_1b_1]$ (ind1): $X \rightarrow M_1 \rightarrow Y$), a standardised coefficient of $\beta = .053$ was obtained associated with a standard error of $se_{boot} = .0104$. Bearing in mind a 95% confidence interval, this produced a confidence interval of .0312-.0717. Considering the fact that this confidence interval does not cover the value 0, it can be concluded that outcomes of this regression analysis are statistically significant. With regards to the second indirect effect ($[a_2b_2]$ (ind2): $X \rightarrow M_2 \rightarrow Y$), a standardised coefficient of $\beta = .052$, $se_{boot} = .0109$ and a 95% CI of .0318-.0747 was obtained. Similarly to that seen with indirect effect 1, it can also be confirmed from this second indirect effect that the regression analysis produced statistically significant outcomes given that the confidence interval does not include the value "0". Finally, with regards to the third effect ($[a_1d_2b_2]$ (ind3): $X \rightarrow M_1 \rightarrow M_2 \rightarrow Y$), outcomes of $\beta = .004$, $se_{boot} = .0018$ and 95% CI .0010-.0079 were achieved. As with the two previously discussed cases (indirect effects 1 and 2), this third indirect effect was also proven to be statistically significant given that the confidence interval did not include the value 0.

It was also relevant, following examination of indirect effects, to determine the most important outcomes and establish whether statistically significant differences existed between them (*post hoc* comparisons). As can be seen in the table presented prior to the first comparison ((c1) Ind1 *minus* Ind2), an effect emerged with a standardised coefficient of $\beta = -.0021$, associated with $se_{boot} = .0161$ and a 95% CI of -.0338-.0246. Given that the value "0" is included within the confidence interval, it can be concluded that no statistically significant differences exist between indirect effect 1 [Twork→WSk→CThink] and indirect effect 2 [Twork→EdMot→CThink]. For this motive, both indirect effects can be considered to be of similar magnitude, even though indirect effect 2 produced a slightly bigger coefficient than indirect effect 1. With regards to the second comparison ((c2) Ind1[Twork→WSk→CThink] *minus* Ind3 [Twork→WSk→ EdMot→CThink]), an effect represented by the standardised coefficient $\beta = .0463$ and associated with $se_{boot} = .0133$, and 95% CI of .0272-.0674 was produced, whilst the third comparison ((c3) Ind2[Twork→EdMot→CThink] *minus* Ind3 [Ind3 Twork→WSk→ EdMot→CThink]), produced a standardised coefficient of $\beta = .0484$, associated with $se_{boot} = .0106$ and a 95% CI of .0286-.0705. In these two cases, given that the confidence intervals did not include the value "0", it can be concluded that statistically significant differences exist between these aforementioned effects. Thus, it can be concluded that sufficient empirical evidence exists to be able to consider indirect effects 1 and 2 larger than indirect effect 3.

Discussion and conclusions of the study

It is well accepted that a close relationship exists between teamwork and critical thinking as this has been strongly demonstrated through the publication of numerous research studies (Sellnow & Ahlfeldt, 2005; Wiggs, 2011 and Plotnikova & Strukov, 2019). A of this prior research presents enough empirical evidence to allow the conclusion that teamwork is a variable that can help to promote critical thinking. Nonetheless, other variables could also be considered in a similar way alongside this variable such as, for example, motivation and teamwork.

The novel contribution made by the present study is that it reaffirms the existence of this direct relationship, whilst also considering the modification of this relationship by specific variables such as work skills and educational motivation (Silva, 2021). In so doing, it places particular emphasis on this final aspect as a fundamental modifying element of the development of critical thinking (Sellnow & Ahlfeldt, 2005; Wiggs, 2011). Motivation is conceptually understood as an element or requirement of the early stages of any ongoing formative process (Ryan, & Deci, 2020 y Diseth et al., 2020). In the present study, it was shown to be a fundamental modifying aspect of the development of critical thinking which, at the same time, is considered to be one of the biggest and most demanded educational outcomes of current training processes and systems (Plotnikova & Strukov, 2019). Thus, the idea that student motivation should propose a concern for teachers at any educational stage appears to be well-founded.

With regards to the conclusions reached in the present study, it should be highlighted, firstly, that the three proposed mediational hypotheses were accepted. In this sense, sufficient empirical evidence was produced to be able to support the conclusion that, essentially, greater teamwork, together with greater future work skills, increase critical thinking: Ind1= Twork→WSk → CThink (hypothesis 1). Further, greater teamwork, together with higher levels of educational motivation increase critical thinking: Ind2 =Twork→EdMot→CThink (hypothesis 2). Finally, greater conceptions of teamwork influenced future work skills which, as a result, also led to higher levels of educational motivation and, finally, greater critical thinking: Ind3=Twork→WSk→EdMot→CThink (hypothesis 3).

Another important aspect to highlight is that the most important of the three mediational effects established was determined. In this regard, it was possible to confirm that sufficient empirical evidence exists for indirect effects 1 and 2 to be able to be considered meaningfully larger than indirect effect 3. With regards to the comparison of indirect effects 1 and 2, despite there not being any differences between them, effect 2 can be considered slightly bigger than effect 1. It can be concluded, therefore, that when teamwork is essentially mediated by work skills and, above all, by educational motivation, a large modifying effect exists in relation to critical think. The sequential mediation found to act on teamwork, when exerted to in-chain mediation by work skills and educational motivation was less relevant, although this mediation was found to be statistically significant and should be considered.

Funding: Project I+D+i , PID2020-119194RB-I00 finance by MCIN/AEI. "Programa Estatal de Generación de Conocimiento y Fortalecimiento Científico y Tecnológico del Sistema de I+D+i y del Programa Estatal de I+D+i Orientada a los Retos de la Sociedad, en el marco del Plan Estatal de Investigación Científica y Técnica y de Innovación 2017-2020".

CRedit authorship contribution statement

Clemente Rodríguez-Sabiote: Data curation, Writing – original draft, Software, Validation, Investigation, Visualization, Writing – review & editing. **Eva María Olmedo-Moreno:** Conceptualization, Methodology, Investigation, Visualization, Writing – review & editing- funding. **Jorge Expósito-López:** Conceptualization, Methodology, Investigation, Visualization, Writing – review & editing.

Ethics approval

The studio has implemented all necessary ethical approvals.

nº: 1858/CEIH/2020

Declaration of Competing Interests

The authors declare no competing interests.

Consent to participate

The authors consent to participate.

Consent for publication

The authors consent to the publication.

References

- Acosta, J.M. (2011). *Trabajo en equipo*. ESIC Editorial.
- Adams, S., Cummins, M., Davis, A., Freeman, A., Glesinger Hall, C. & Ananthanarayanan, V. (2017). *NMC Horizon Report: 2017 Higher Education Edition*. The New Media Consortium.
- Atxurra, C., Villardón-Gallego, L. & Calvete, E. (2015). Diseño y validación de la Escala de Aplicación del Aprendizaje Cooperativo (CLAS). *Revista de Psicodidáctica*, 20(2), 339-357. <https://doi.org/10.1387/revpsicodidact.11917>
- Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191- 215. <https://doi.org/10.1037/0033-295x.84.2.191>
- Bandura, A. (1999). *Auto-eficacia: cómo afrontamos los cambios de la sociedad actual*. Desclée De Bower.
- Bandura, A. (2001). Guía para la construcción de Escalas de Autoeficacia.(versión revisada). Universidad The Stanford.
- Baron, R. M. & Kenny, D. A. (1986). The moderator-mediator variable distinctions in social psychological research. Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173-1182. <https://doi.org/10.1037/0022-3514.51.6.1173>
- Barraycoa Martínez, Javier. & Lasaga Millet, Olga (2010). La competencia de trabajo en equipo: más allá del corta y pega. *Vivat Academia*, (111), 63-69. <https://doi.org/10.15178/va.2010.111.65-69>
- Cummins, R. A. & Gullone, E. (2000). Why we should not use 5-point Likert scales: The case for subjective quality of life measurement. Proceedings, *Second Conference on Quality of Life in Cities*, 74(2), 74-93.
- Davies, A., Fidler, D. & Gorbis, M. (2011). Future work skills 2020: *The reworking of "work"*. Institute for the Future for University of Phoenix Research Institute. <http://hdl.voced.edu.au/10707/194830>.

- Deci, E. L. & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227-268. https://doi.org/10.1207/s15327965pli1104_01
- Dillman, D. A. (2007). *Mail and internet surveys: The tailored design method*. John Wiley & Sons.
- Dillman, D.A. (2011). *Mail and Internet surveys: The tailored design method. 2007 update with new internet, visual, and mixed-mode guide*. (2^a ed.). John Wiley & Sons.
- Diseth, Å., Mathisen, F. K. S. & Samdal, O. (2020). A comparison of intrinsic and extrinsic motivation among lower and upper secondary school students. *Educational Psychology*, 40(8), 961-980. <https://doi.org/10.1080/01443410.2020.1778640>
- Esmaeili, L., Sohrabi, N., Mehryar, A. & khayyer, M. (2020). The causal model of learning strategies (cognitive and metacognitive) mediated by academic hope for academic self-efficacy in shiraz high school students. *Psychological Methods and Models*, 10(38), 247-262. <https://doi.org/10.29252/ieepj.1.3.179>
- Expósito López, J., Romero-Díaz de la Guardia, J. J., Olmos-Gómez, M. D. C., Chacón-Cuberos, R. & Olmedo-Moreno, E. M. (2019). Enhancing skills for employment in the workplace of the future 2020 using the theory of connectivity: shared and adaptive personal learning environments in a spanish context. *Sustainability*, 11(15), 4219. <https://doi.org/10.3390/su11154219>
- Expósito-López, J., Romero-Díaz de la Guardia, J. J., Olmedo-Moreno, E. M., Pistón Rodríguez, M. D. & Chacón-Cuberos, R. (2021). Adaptation of the educational motivation scale into a short form with multigroup analysis in a vocational training and baccalaureate setting. *Frontiers in Psychology*, 12, 1682. <https://doi.org/10.3389/fpsyg.2021.663834>
- Franco, C. A. & Velásquez Vásquez, F. (2000). Cómo mejorar la eficiencia operativa utilizando el trabajo en equipo. *Estudios Gerenciales*, 16(76), 27-35. https://www.icesi.edu.co/revistas/index.php/estudios_gerenciales/article/view/42
- Galleguillos Herrera, P. & Olmedo Moreno, E. M. (2017). Autoeficacia académica y rendimiento escolar: un estudio metodológico y correlacional en escolares. *Revista Electrónica de Investigación y Docencia Creativa*, 6, 156-169. <https://doi.org/10.30827/digibug.45469>
- Galleguillos-Herrera, P. & Olmedo-Moreno, E. M. (2019). Academic self-efficacy and motivation: a measurement for the achievement of school objectives. *European Journal of Investigation in Health, Psychology and Education*, 9(3), 119-135. <https://doi.org/10.30552/ejihpe.v9i3.329>.
- Gillet, N., Vallerand, R. J. & Lafrenière, M. A. K. (2012). Intrinsic and extrinsic school motivation as a function of age: The mediating role of autonomy support. *Social Psychology of Education*, 15(1), 77-95. <https://doi.org/10.1007/s11218-011-9170-2>

- González Ferreras, J. M. & Wagenaar, R. O. (Eds.) (2003) *Tuning educational structures in Europe. Informe final. Fase I*. Universidad de Deusto- Universidad de Groningen.
- González, J., & Wagenaar, R. O. (2008). *Tuning educational structures in Europe. Informe final. Fase I*. Universidad de Deusto- Universidad de Groningen.
- González, J., & Wagenaar, R. O. (2008). *Turning educational structures in Europe. Universities' contribution to the Bologna Process. An introduction. 2nd Edition. University of Deusto*.
- Haber, J. (2020). *Critical thinking*. MIT Press.
- Hayenga, A. O. & Corpus, J. H. (2010). Profiles of intrinsic and extrinsic motivations: A person-centered approach to motivation and achievement in middle school. *Motivation and Emotion*, 34(4), 371-383. <https://doi.org/10.1007/s11031-010-9181-x>
- Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication Monographs*, 76(4), 408-420. <https://doi.org/10.1080/03637750903310360>
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Press.
- Hebles, M., Llanos-Contreras, O. & Yániz-Álvarez-de-Eulate, C. (2019). Evolución percibida de la competencia para emprender a partir de la implementación de un programa de formación de competencias en emprendimiento e innovación. *Revista Española de Orientación y Psicopedagogía*, 30(1), 9–26. <https://doi.org/10.5944/reop.vol.30.num.1.2019.25191>
- Honicke, T. & Broadbent, J. (2016). The influence of academic self-efficacy on academic performance: A systematic review. *Educational Research Review*, 17, 63-84. <https://doi.org/10.1016/j.edurev.2015.11.002>
- Karlen, Y., Suter, F., Hirt, C. & Merki, K. M. (2019). The role of implicit theories in students' grit, achievement goals, intrinsic and extrinsic motivation, and achievement in the context of a long-term challenging task. *Learning and Individual Differences*, 74, 101757. <https://doi.org/10.1016/j.lindif.2019.101757>
- Mahou Fernández, A. M. & Díaz Pérez de la Lama, S. (2018). La cuarta revolución industrial y la agenda digital de las organizaciones. *Economía Industrial*, 407, 95-104.
- Martínez León, P., Ballester Roca, J. & Ibarra Rius, N. (2019). Construcción de identidades genéricas desde la educación literaria en el último curso de Secundaria. *El Guiniguada*, 29, 30-41. <https://doi.org/10.20420/elguiniguada.2020.336>

- Matas, A. (2018). Diseño del formato de escalas tipo Likert: un estado de la cuestión. *Revista Electrónica de Investigación Educativa*, 20(1), 38-47. <https://doi.org/10.24320/redie.2018.20.1.1347>

Katz, M. H. (2006). *Multivariable analysis: A Practical Guide for Clinicians* (2nded.). Cambridge University Press.

- Maxwell, J. (2008). Designing a qualitative study. In L. Bickman & D. J. Rog (Eds.), *The SAGE handbook of applied social research methods* (2 ed., Vol. 2, pp. 214-253). SAGE Publications, Inc.

- McDonald, R. P. (1999). *Test theory: A unified treatment*. Lawrence Erlbaum Associates, Inc.

- Merino-Marban, R., Mayorga-Vega, D., Fernandez-Rodriguez, E., Estrada, F. V. & Viciano, J. (2015). Effect of a physical education-based stretching programme on sit-and-reach score and its posterior reduction in elementary schoolchildren. *European Physical Education Review*, 21(1), 83-92. <https://doi.org/10.1177/1356336x14550942>

- Ntoumanis, N., Ng, J. Y., Prestwich, A., Quested, E., Hancox, J. E., Thøgersen-Ntoumani, C., Deci, E. L., Ryan, R. M. Lonsdale, C. & Williams, G. C. (2021) A meta-analysis of self-determination theory-informed intervention studies in the health domain: effects on motivation, health behavior, physical, and psychological health. *Health Psychology Review*, 15(2), 214-244. <https://doi.org/10.1080/17437199.2020.1718529>

- Núñez Alonso, J., Martín-Albo Lucas, J. & Navarro Izquierdo, J. G. (2005). Validación de la versión española de la echelle de motivation en education. *Psicothema*, 17(2), 344-349.

- Núñez Alonso, J. L., Martín-Albo, J., Navarro Izquierdo, J. G. & Suárez, Z. (2010). Adaptación y validación de la versión española de la Escala de Motivación Educativa en estudiantes de educación secundaria postobligatoria. *Estudios de Psicología*, 31(1), 89-100. <https://doi.org/10.1174/021093910790744590>

- Nussbaum, M. C. & Mosquera, A. S. (2012). *Crear capacidades. Propuesta para el desarrollo humano*. Paidós.

- Patall, E. A., Steingut, R. R., Vasquez, A. C., Trimble, S. S., Pituch, K. A. & Freeman, J. L. (2018). Daily autonomy supporting or thwarting and students' motivation and engagement in the high school science classroom. *Journal of Educational Psychology*, 110(2), 269. <https://doi.org/10.1037/edu0000214>

- Pelletier, L. G., Rocchi, M. A., Vallerand, R. J., Deci, E. L. & Ryan, R. M. (2013). Validation of the revised sport motivation scale (SMS-II). *Psychology of Sport and Exercise*, 14(3), 329-341. <https://doi.org/10.1016/j.psychsport.2012.12.002>

- Plotnikova, N. & Strukov, E. N. (2019). Integration of teamwork and critical thinking skills in the process of teaching students. *Cypriot Journal of Educational Sciences*, 14(1), 1-10. <https://doi.org/10.18844/cjes.v14i1.4031>

- Rockwood, N. J. & Hayes, A. F. (2020). Mediation, moderation, and conditional process analysis: Regression-based approaches for clinical research. In A.G.C. Wright. & M.N. Hallquist (Eds.), *The Cambridge Handbook of Research Methods in Clinical Psychology* (pp. 396-414). Cambridge University Press.
- Romero-Díaz de la Guardia, J.J., García-Garnica, M., Chacón-Cuberos, R. & Expósito, J. (202x). *Psychometric validation of a teamwork skills scale in a vocational training context*. Sage Open, (in review).
- Rönnlund, M., Ledman, K., Nylund, M. & Rosvall, P. Å. (2019). Life skills for ‘real life’: How critical thinking is contextualised across vocational programmes. *Educational Research*, 61(3), 302-318. <https://doi.org/10.1080/00131881.2019.1633942>
- Preacher, K. J. & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers*, 36(4), 717-731. <https://doi.org/10.3758/bf03206553>
- Putwain, D., Sander, P. & Larkin, D. (2013). Academic self-efficacy in study-related skills and behaviours: Relations with learning-related emotions and academic success. *British Journal of Educational Psychology*, 83(4), 633-650. <https://doi.org/10.1111/j.2044-8279.2012.02084.x>
- Ryan, R. M. & Deci, E. L. (2016). Facilitating and hindering motivation, learning, and well-being in schools. (2^a ed., pp. 96-119). In K. R. Wentzel. & D. B. Miele (Eds.), *Handbook of Motivation at School*. Routledge <https://doi.org/10.4324/9781315773384-12>
- Ryan, R. M. & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Publications. <https://doi.org/10.1521/978.14625/28806>
- Ryan, R. M. & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, 61, 101860. <https://doi.org/10.1016/j.cedpsych.2020.101860>
- Schunk, D. H. & Zimmerman, B. J. (Eds.). (2012). *Motivation and self-regulated learning: Theory, research, and applications*. Routledge.
- Sellnow, D. D. & Ahlfeldt, S. L. (2005). Fostering critical thinking and teamwork skills via a problem-based learning (PBL) approach to public speaking fundamentals. *Communication Teacher*, 19(1), 33-38. <https://doi.org/10.1080/1740462042000339258>
- Silva H., Lopes J., Morais E., Dominguez C. (2021) Cooperative Learning and Critical Thinking in Face to Face and Online Environments. In A. Reis., J. Barroso., J.B. Lopes., T. Mikropoulos. & CW. Fan (Eds.) Technology and Innovation in Learning, Teaching and Education. TECH-EDU 2020. *Communications in Computer and Information Science* (Vol. 1384, pp. 168) . Springer. https://doi.org/10.1007/978-3-030-73988-1_12

- Sosu, E. M. (2013). The development and psychometric validation of a Critical Thinking Disposition Scale. *Thinking Skills and Creativity*, 9, 107-119. <https://doi.org/10.1016/j.tsc.2012.09.002>
- Støen Utvær, B. K. & Haugan, G. (2016). The academic motivation scale: dimensionality, reliability, and construct validity among vocational students. *Nordic Journal of Vocational Education and Training*, 6(2), 17-45. <https://doi.org/10.3384/njvet.2242-458x.166217>
- Suárez Riveiro, J. M., Fernández Suárez, A. P., Rubio Sánchez, V. & Zamora Menéndez, Á. (2016). Incidencia de las estrategias motivacionales de valor sobre las estrategias cognitivas y metacognitivas en estudiantes de secundaria. *Revista Complutense de Educación*, 27(2), 421. https://doi.org/10.5209/rev_rced.2016.v27.n2.46329
- Sukhodolov, Y. A. (2019). The notion, essence, and peculiarities of industry 4.0 as a sphere of industry. En E.G. Popkova, Y. V. Ragulina. & A. V. Bogovic (Eds.), *Industry 4.0: Industrial Revolution of the 21st Century* (pp. 3-10). Springer. https://doi.org/10.1007/978-3-319-94310-7_1
- Takahashi, C. & Im, S. (2020). Comparing Self-Determination Theory and the L2 motivational self system and their relationships to L2 proficiency. *Studies in Second Language Learning and Teaching*, 10(4), 673-696. <https://doi.org/10.14746/ssllt.2020.10.4.2>
- The jamovi project (2021). *Jamovi* (Version 1.6) [Computer Software]. <https://www.jamovi.org>
- Tsyganova, L. V., Zubkova, Y. V., Bystrova, N. V., Kutepova, L. I. & Kutepov, M. M. (2020). Game technologies as a means of increasing the educational motivation of university students. *Propósitos y Representaciones*, 9(1), 808. <http://dx.doi.org/10.20511/pyr2021.v9nSPE1.808>
- Van der Zanden, P. J., Denessen, E., Cillessen, A. H. & Meijer, P. C. (2018). Domains and predictors of first-year student success: A systematic review. *Educational Research Review*, 23, 57-77. <https://doi.org/10.1016/j.edurev.2018.01.001>
- Virkkula, E. (2020). Evaluating motivational characteristics in vocational music education within the perspective of self-determination theory. *Empirical Research in Vocational Education and Training*, 12(1), 1-15. <https://doi.org/10.1186/s40461-020-00098-5>
- Wiggs, C. M. (2011). Collaborative testing: Assessing teamwork and critical thinking behaviors in baccalaureate nursing students. *Nurse Education Today*, 31(3), 279-282. <https://doi.org/10.1016/j.nedt.2010.10.027>
- Zimmerman, B. J. (2008). Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects. *American Educational Research Journal*, 45(1), 166-183. <https://doi.org/10.3102/0002831207312909>

- Zumbo, B. D., Gadermann, A. M. & Zeisser, C. (2007). Ordinal versions of coefficients alpha and theta for Likert rating scales. *Journal of Modern Applied Statistical Methods*, 6(1), 21-29. <https://doi.org/10.22237/jmasm/1177992180>