

Teacher Self-regulation: Validation of Scales in Chile Applied with an Online Technological Tool

Autorregulación Docente: Validación de Escalas en Chile Aplicadas con una Herramienta Tecnológica Online

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Abstract

Teacher self-regulation is of great importance because it allows an organized and structured professional exercise, it also facilitates a successful performance of the teaching and learning process, allowing the teacher to monitor the effectiveness of their pedagogical practices and modeling of self-regulatory skills in students. The objective of this study was to adapt and validate scales to measure teaching self-regulation processes in Spanish and with evidence of its functionality by application of technological tools. The study was quantitative, with an instrumental design. The sample consisted of 204 secondary school teachers in Chile. The scales were adapted from the Teacher Self-regulation Scale and underwent back-translation procedures, cognitive interviews, confirmatory factor analysis, and reliability analyses. The results showed adequate validity and reliability estimators for seven scales corresponding to goal setting, intrinsic interest, performance goal orientation, goal mastery orientation, self-instruction, emotional control, and self-evaluation. In conclusion, the scales allow valid and reliable measurement of teaching self-regulatory processes.

Keywords: Teacher self-regulation, psychometric, secondary education, online surveys, surveys for mobile devices.

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Resumen

La autorregulación docente es de gran importancia porque permite un ejercicio profesional organizado y estructurado, además facilita un desempeño exitoso del proceso de enseñanza y aprendizaje, permitiendo al docente monitorear la efectividad de sus prácticas pedagógicas y modelar habilidades de autorregulación en sus estudiantes. El objetivo de este estudio fue adaptar y validar escalas para medir procesos de autorregulación docente en español y con evidencia de su funcionalidad mediante la aplicación de herramientas tecnológicas. El estudio fue cuantitativo, con un diseño instrumental. La muestra estuvo constituida por 204 profesores de Educación Media de Chile. Las escalas fueron adaptadas de la Teacher Self-regulation Scale y sometidas a procedimientos de retrotraducción, entrevistas cognitivas, análisis factorial confirmatorio y análisis de confiabilidad. Los resultados mostraron estimadores adecuados de validez y confiabilidad para las siete escalas correspondientes a establecimiento de metas, interés intrínseco, orientación a metas de desempeño, orientación a metas de dominio, autoinstrucción, control emocional y autoevaluación. En conclusión, las escalas permiten una medición válida y fiable de los procesos de autorregulación de la enseñanza.

Palabras clave: Autorregulación docente, psicometría, educación secundaria, encuestas en línea.

Teaching challenges in the current educational context

A teacher's role is difficult and complex because, in addition to effectively managing classroom activities, student behaviors and other situational stressors, they are expected to provide high-quality teaching (Cleary et al., 2022). Classrooms are increasingly diverse and complex due to student body variations in interests, cultural backgrounds, ability and learning pace, which is why teachers are required to adapt the learning environment as far as possible to individual needs and the heterogeneity of competencies. This entails the additional challenge to teachers to provide an adequate education (Barbier et al., 2022). Conduction of the teaching practice has become the center of interest for improving educational policies that contribute to improve educational quality for new generations of students (Zeichner et al., 2015).

Secondary education students are required to be adaptable, critical, and creative thinkers, problem solvers, capable of working and learning both independently and collaboratively, monitoring and evaluating their study processes and making adjustments to achieve effective learning, thus, they self-regulate their learning (Brenner, 2022). There is clear evidence showing that the development of self-regulation in students is a significant source of differential performance among students and a competence that crosses sociodemographic boundaries (Perry et al., 2018), and is perfectible, that is, all students may enhance their self-regulatory skills, including those with exceptional learning needs, and use these skills to support their learning (Perry et al., 2020).

Therefore, to reach academic goals and achieve success in the educational process, an effort is required not only from the students, but also from their teachers; for this reason, teachers are expected to go beyond learning to teach a specific and/or disciplinary content area and, in addition, learn to self-regulate their teaching process to be models of self-regulation during their classes (Spruce & Bol, 2015).

Importance of teacher self-regulation

Although a set of teaching practices has been identified to promote self-regulated learning in students, which can be implemented by teachers to create opportunities to promote self-regulatory processes in their students during classes (Perry et al., 2018); it has recently been pointed out that teacher self-regulation functions significantly as a key indicator for the development and successful performance of regulatory mechanisms in students (Gastager et al., 2022). Despite the emerging emphasis on teaching self-regulatory skills, teachers often feel inadequately prepared and consequently unable to support or incorporate self-regulation into their teaching. This gap in the application of self-regulatory processes is particularly problematic for teachers working in secondary education, given that these contexts often imply higher demands and expectations of self-sufficiency and autonomy by students (Cleary et al., 2022).

Teacher self-regulation makes it easier to monitor the effectiveness of the pedagogical practices used and to promote and model self-regulatory learning skills in students (Azari-Noughabi & Amirian, 2021). In other words, directly involving teacher self-regulation processes also has positive implications for the academic achievement of students within the educational context. Teaching in a self-regulated way means that teachers need to regulate their instruction before, during and after the development of classes, thus improving the effectiveness of their teaching (Chatzistamatiou et al., 2014). Therefore, teachers' self-regulatory capacity facilitates a reciprocal learning process for teaching and teaching to learn (Capa-Aydin et al., 2009).

From the social-cognitive perspective (Bandura, 2006), self-regulated teachers can activate their beliefs to take appropriate measures that lead to successful and effective teaching, they manage to deploy different personal strategies and sustain their motivation when encountering different tasks. Diverse students and changing circumstances promote a better understanding of teaching needs and experiences, becoming role models for students, and promoting self-regulatory skills to meet academic demands, challenges, and effective learning.

Conceptualization of teacher self-regulation

Within the relevant literature, it is possible to identify at least three definitions of teacher self-regulation. The first defines it as the strategies for monitoring performance, seeking help, controlling emotions, and setting performance goals that teachers execute in their professional practice to achieve goals and overcome professional obstacles (Azari-Noughabi & Amirian, 2021). The second defines it as the active processes through which the teacher directs and maintains their metacognition, motivation, and strategies for effective instruction (Chatzistamatiou et al., 2014). The third defines it as the setting of learning goals, high motivation, the use of self-directed learning strategies and self-control, and self-assessments and reflections with a positive attitude and adjustment of strategies (Pei & Yang, 2019).

Although there is no single definition of teacher self-regulation, there is agreement in understanding it as an active process where the teacher deploys metacognitive and motivational strategies for effective instruction in the educational context through a cycle of planning, execution and self-assessment of their professional practice that allows them to control and regulate their teaching practices.

Empirical Evidence

Research has found that teacher self-regulation is decisive for successful teaching processes, given that, if teachers demonstrate greater security when performing professionally, they obtain greater satisfaction in relation to their pedagogical work as a result. For example, a study (Heydarnejad et al., 2021), whose sample was teachers in English, showed that the variable of teacher self-regulation and teaching style was significantly and positively related with the teacher who had a facilitator style characterized by applying an approach focused on self-learning and self-discovery, which results in independent and responsible students ($r = .420, p < .05$), and teachers with a delegating style that improves autonomy and confidence in students, using work group and collaboration. ($r = .411, p < .05$), ergo, those teachers with higher levels of academic self-regulation show an improved teaching style and strategies for implementing their classes and are often facilitators.

A study (Peeters et al., 2014) explains that teaching as a profession requires self-regulation skills on the part of teachers to develop student self-regulation and make it easier for students to participate in complex and meaningful work, providing the opportunity to control their learning processes and study.

On the other hand, an investigation carried out in Germany with mathematics teachers in primary and secondary education (Dignath & Büttner, 2018), shows that teachers at both educational levels need training to improve the self-regulated learning progress in students that allows them to provide more learning spaces, facilitation of autonomy, and use of metacognitive strategies.

An investigation carried out in Spain with primary and secondary education teachers (Alsina et al., 2018), suggests that there are aspects that should be found implicit in initial teacher training. These must refer to knowledge and beliefs from their previously lived experiences. Hence, those teachers who have had experiences in their training trajectories with emphasis on practices that increase their self-regulatory processes, will also replicate it in their professional practice. However, many teachers have not had strong training with an emphasis on self-regulated teaching.

A mixed study investigated the knowledge of secondary school teachers about self-regulation and their self-efficacy and skills in the application of strategies promoting self-regulation in their students. After teachers participated in a professional development workshop, the results showed that teachers who developed advanced self-regulation skills after the workshop showed more flexible, receptive and positive perspectives in the implementation of practices that promote self-regulation in their classrooms, in comparison with the classrooms of those teachers with barely emerging self-regulatory skills (Cleary et al., 2022).

Specifically in the case of Chile, there is an incipient investigation on teacher self-regulation, since this has focused mainly on students. For example, two different studies analyzed teaching practices to promote self-regulation in students, and in the results both studies showed that they lack the necessary knowledge to promote this competence (López-Angulo et al., 2022; Sáez-Delgado et al., 2023). Therefore, the lack of research to measure the self-regulatory processes of teachers themselves could be explained by the limited availability of reliable scales to measure this variable in Spanish.

As demonstrated, there is concrete evidence that allows us to affirm that teacher self-regulation is relevant and essential for successful teaching and learning processes. The teacher will have the ability

to critically monitor and self-assess their professional performance, progressively advancing towards an appropriate teaching style that needs to be implemented in their classes in coherence with the pedagogical needs and challenges; they will be able to meticulously find both the positive and negative sides of the approaches, activities or teaching practices that they will use in their interventions with the student body, having them as central figures in this process.

Gap in research: Lack of scales to measure teacher self-regulation in an online format

It is relevant to consider that self-regulation is a strategic action in education that, until now, has focused research mainly on students (Chatzistamatiou et al., 2014). Therefore, although there are scales on the phenomenon of self-regulation in the academic context, they have focused mainly on students. A systematic review of the literature identified 10 instruments that allow the evaluation of self-regulation learning strategies in Secondary Education students (López-Angulo et al., 2022).

In the case of teachers, the existing scales have focused on how the teacher promotes self-regulation or how self-efficacious they perceive themselves to be in promoting self-regulatory competence in their students. For example, there is a scale on teaching beliefs regarding the self-regulation of learning, the scale on knowledge of self-regulation processes (Sáez-Delgado et al., 2021) and a scale of teaching practices to promote self-regulation of learning in students; similarly, the Teacher Self-Efficacy Scale for the promotion of self-regulation of learning (Sáez-Delgado et al., 2020). However, there is little evidence of studies focused on the teacher's own self-regulation regarding their professional practice.

These few studies have used scales that measure some dimensions of self-regulation or from a specific theory, for example, Shaver (2010) used the MSLQ Scale developed by Pintrich et al. (1991), however, this instrument focuses mainly on motivational aspects and the use of learning strategies; another study by Sáez et al. (2022), measured self-regulation with an instrument composed of dimensions that represent the classic three-phase theory of Zimmerman (2000), but these scales do not consider some important regulation dimensions in teachers such as emotional control.

An instrument that aims to measure teacher self-regulation is the so-called Teacher Self-Regulation Scale (TSRS), designed and validated by Capa-Aydin et al. (2009). However, its version translated into Spanish is not currently available, nor are there experiences of its application in virtual mode.

Electronic records offer several advantages over paper records in that the data is readily available for analysis, such as data mining. However, the surveys have mainly relied on paper-based methods, using techniques of home visits, face-to-face conversations, interviews, distribution of questionnaires, completion of questionnaires, completion of forms under direct supervision, etc. This leads to different challenges in the application of the instruments, high associated costs, and methodological errors (Weigold et al., 2013). Experimental research demonstrated in a sample of young adults aged 19-30 that an online survey application mode generates a higher response rate compared to the pen and paper protocol (Patrick et al., 2021). The challenge is to transform paper data into an electronic format for processing and analysis. Even when data is available electronically, it is often reduced to paper format before the data is captured. This is inefficient and expensive and leads to more inadequate data (Nayak & Narayan, 2019).

The specialized literature identifies and systematizes the advantages and potentialities of online scales, which can be classified into five dimensions: (1) advantages in design, (2) advantages related to the sample, (3) advantages in data collection procedures, (4) advantages in data analysis procedures, and (5) advantages in ethical aspects. Regarding the design of online surveys, they provide an effective configuration of self-report scales with Likert and continuous rating, as well as a flexible, interactive, graphical, and multimedia visualization that is attractive to users with different response options. Regarding sampling, online surveys enjoy high acceptance by participants of all ages, are feasible and effective for collecting data on sensitive topics or with difficult-to-access samples (e.g., vulnerable populations, with a medical condition, with a special educational need, or from distant or complex geographic locations). Regarding data collection procedures, online surveys are easy to apply, they allow the collection of large amounts of data in a short time, ensuring good coverage and lower cost, they also do not require the presence of interviewers (interviewer effects are eliminated, social desirability effects are reduced, health contagion is prevented, they produce more representative results), the participant can respond at the time that suits him/her best, take the time needed to answer the questions, and complete the survey in several sessions. It also solves problems of loss of information since it is possible to program warnings to respondents of unanswered fields before moving on to the next section. It solves the technical problem of entering incorrect data such as the selection of two alternatives in the same question by programming alerts for duplicity of answers. Regarding data analysis procedures, it reduces errors in the transfer of information by not having to transfer written data to a computer, allows the application of robust statistical analysis, facilitates follow-up in longitudinal studies, reducing the different types of measurement errors. Finally, at an ethical level, it allows a more agile and secure treatment of the participant's personal data, reducing the possibility of revealing personal information, since the scales do not pass through the hands of interviewers, they are immediately safeguarded and coded in technological systems such as clouds with access codes (Duffy et al., 2005; Simmons & Bobo, 2015; Zhang et al., 2017).

Considering the different characteristics and variations in the application of a pencil and paper survey compared to an online survey, it is necessary to validate the respective application formats in order to respond to these substantial differences. Therefore, the objective of this study was to adapt and validate scales to measure the self-regulation processes of teachers in Spanish and with evidence of its functionality in an application using technological tools. Therefore, the hypothesis of this study was: The Spanish version of the TSR scale is valid for measuring teacher self-regulation processes in an online application format.

Methods

Design

The study was carried out from the quantitative approach and used an instrumental design (Ato et al., 2013) typical of research whose purpose is the adaptation of scales or the study of their psychometric properties. In educational psychology it is essential to have instruments for the measurement of latent variables that allow valid and reliable results. Two stages were deployed, the first for the adaptation of the scale from English to Spanish, which included a back-translation process (Tyupa, 2011), and cognitive interviews (Padilla & Leighton, 2017); Peterson et al. (2017); (Willis, 2018; Willis, 2015); secondly the factorial confirmation of the structure of each dimension.

Sample

Access to the sample of teachers was by convenience, during the last quarter of the 2021 academic year (October to December). The sample consisted of 204 teachers, with an average age of 35.71 (SD = 9.99) years, of whom 85 (41.7%) were men and 119 (58.3%) were women. Regarding teaching experience, on average, they declared having 9.60 (SD = 8.96) years of experience, also on average they declared having 38.83 (SD = 6.58) hours of contracted employment. Faced with the question of how many students, on average, are enrolled in their courses, 71 (34.8%) teachers declared that they give classes to courses of between 31 and 40 students, 58 (28.4%) to courses of between 21 and 30 students, 44 (21.6%) to courses with between 41 to 50 students, 20 (9.8%) to courses with between 11 to 20 students, 10 (4.9%) to courses with between 1 to 10 students and 1 (0.4%) to courses with more than 50 students.

Regarding the county of the institution where they practice, 68 (33.3%) work in San Pedro de la Paz, 50 (24.5%) in Concepción, 42 (20.6%) in Tomé, 13 (6.4%) in Coronel and 31 (15.2%) in other counties. In relation to the mode in which they currently impart their classes, 167 (81.9%) declared that they were teaching in hybrid mode, 28 (13.7%) in face-to-face mode and 9 (4.4%) in online mode.

Instrument

To measure teacher self-regulation, the so-called Teacher Self-regulation Scale (TSRS) was used (Capa-Aydin et al., 2009). Which was based on the self-regulation model of Zimmerman, that postulates three cyclical phases that include forecasting, performance control and self-reflection; this allows us to examine the multidimensional construct of teacher self-regulation (Zimmerman, 2000). The design and validation of this scale was carried out with a sample of teachers in training who were about to complete their study program. As a pilot test, the first sample used corresponded to 320 trainee teachers from Turkey, which allowed us to examine the factorial structure of the construct. The second sample of 898 trainee teachers from this same country was used for cross-validation.

The results of the research (Capa-Aydin et al., 2009) confirmed nine scales: (1) Goal setting with 6 items and $\alpha = .86$, referring to the process of setting goals to guide actions during instruction, an example of an item is “When I prepare classes, I identify the goals that should be reached by my students”; (2) Intrinsic interest with 5 items and $\alpha = .85$, referring to beliefs about personal interest in the profession, an example of items is “It makes me happy to see my students learn”; (3) Orientation to performance goals with 5 items and $\alpha = .78$, referring to the goals to perform better than others as a teacher and to appreciate their competence, an example of items is “My goal as a teacher is to get a promotion”; Mastery goal orientation with 4 items and $\alpha = .67$, referring to objectives to improve teaching competence and master the teaching task regarding the standards established by oneself, an example of these items is “My goal as a teacher is to improve the learning of my students”; Self-instruction with 4 items and $\alpha = .78$, referring to the process of monitoring one’s own performance in teaching and making changes in instruction when necessary, an example of items is “I self-manage to use my time effectively”; (6) Emotional control with 5 items and $\alpha = .73$, referring to strategies to control and regulate affect, mood and emotions, an example of these items is “When I face a problem, I stay calm”; (7) Self-assessment with 4 items and $\alpha = .62$, referring to the evaluation process of the current teaching performance comparing it with previously established objectives and with previous performance, an example of these items is “At the end of the

class, I try to determine if I have achieved my goals or not”; (8) Self-reaction with 4 items and $\alpha = .66$, referring to the affective responses after a teaching performance, an example of items is “If the teaching strategies that I have used do not work, I use alternative strategies”; (9) Seeking help with 3 items and $\alpha = .78$, referring to obtaining help from others to solve the problems encountered in the teaching process, an example of an item is “While I prepare classes, I get help from my colleagues when I need it”.

Data collection procedure

This cross-sectional study was part of the first stage of the FONDECYT Project 11201054 of the Chilean National Agency for Research and Development, which was carried out in the second half of 2021. It followed three procedures: (a) back-translation of the scales, (b) cognitive interviews and (c) trust factor analysis.

To adapt the TSRS to Spanish, the translation-back translation method was applied following previous studies (Arafat et al., 2016). A professional translation service was requested from a native English speaker and bilingual translator (qualified translator with a high level of English and Spanish). After the translation of the scale into Spanish, it was again translated into English by another translator with knowledge of translation in the area of educational psychology. After collecting both back-translated versions, they were compared and submitted to an expert panel made up of three researchers participating in the Project. The panel completed the review of the different scales of the TSRS and the final version was agreed upon.

After the first version of the TSRS was obtained, it was digitized for its application in online format using the SurveyMonkey® tool. Cognitive interviews were planned to justify the validity evidence of the instrument’s response format and to identify possible complications in comprehension of the instructions, drafting of the items, or response scales. The participants in this process were a total of 7, specifically 4 secondary teachers and 3 teachers-in-training. Cognitive interviews were conducted individually with each participant on the zoom platform. The participants shared their screen and began to answer the instrument. The interviewer recorded some details regarding the understanding of the items. After the interviews, all the comments, observations, and/or suggestions for improvement were systematized and incorporated.

The new version of the scales was applied with the aim of subsequently performing confirmatory factor analysis. To recruit participants, principals of public secondary schools in the Biobío Region were approached. They were informed about the first stage of the research project, its objective, and the retribution mechanisms referred to the delivery of a report with the global results of the study. In the schools that were willing to participate, an official was designated to facilitate contact between the researchers and the teaching staff. After explaining the study, each teacher received, by e-mail, a link to the online TSRS questionnaire.

This study was approved by the Ethics Committee of the Universidad Católica de la Santísima Concepción, Chile and was conducted according to the Declaration of Helsinki. Informed consent was included in the first section of the survey. Only the teachers who agreed to be part of the study were considered for data analysis. All participants were informed of the confidentiality of their responses, and were provided with information on the nature, purpose of the study, the procedure, as well as their right to withdraw or stop being part of the research at any time.

Data analysis procedure

A descriptive analysis of the results was first performed, then confirmatory factor analysis was carried out to assess the dimensional structure of the 9 scales using the MLR estimator, suitable for ordinal items.

For the global evaluation of the models of each scale, the adjustment statistics and their respective criteria recommended in the literature (Schermelleh-Engel et al., 2003) were applied. In the case of the Chi square (χ^2), we note that the χ^2/df shows a good fit with a value lower than 3; the comparative fit index (CFI) and the non-normed fit index (TLI) show an acceptable fit with a value of 0.90 and 0.95; Finally, the root mean square error of approximation (RMSEA), with a value of .08 (90% CI .10) is an indicator of an acceptable fit, while a value of .05 (90% CI .08) is considered a good fit.

Reliability, as a type of internal consistency, was calculated by means of Cronbach's Alpha coefficient as well as McDonald's Omega. This last coefficient is considered favorable for scales where the assumption of tau-equivalence is not fulfilled; that is, those whose factor loads are dissimilar to each other (Trizano-Hermosilla & Alvarado, 2016). All analyses were performed using the R (Team, 2022).

Results

Results of the confirmatory factor analyses of each scale

In general, significant factorial loadings were found for the items on 7 scales: Goal setting, Intrinsic interest, Performance goal orientation, Mastery goal orientation, Self-instruction, Emotional control, Self-assessment (See Table 1). Items with inadequate loadings below .035 were eliminated. However, in two scales (Help-seeking and Self-reaction), when eliminating items due to inadequate loads, they were left with an insufficient number of items to account for the construct and, therefore, were eliminated.

Table 1

Factor loads of one-dimensional teacher self-regulation scales (English and Spanish)

Item #	Item name	Factorial loading
(1) Goal setting		
1	When I prepare a class, I decide the appropriate teaching strategy according to the learning objectives (Cuando preparo clases, decido la estrategia de enseñanza apropiada según el/los objetivos de aprendizaje).	.672
2	When I prepare a class, I consider the characteristics of my students (Cuando preparo clases, considero las características de mis estudiantes).	.861
3	When I prepare a class, I decide how to assess my students (Cuando preparo clases, decido cómo evaluar a mis estudiantes).	.348
4	When I prepare a class, I consider the needs of my students (Cuando preparo clases, tengo en cuenta las necesidades de mis estudiantes).	.763
(2) Intrinsic interest		
1	I like my profession (Me gusta mi profesión).	.747

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Item #	Item name	Factorial loading
2	It makes me happy to see my students learn (Me hace feliz ver a mis estudiantes aprender).	.640
3	I am proud to work as a teacher (Me siento orgulloso de trabajar como docente).	.573
4	I attend classes with enthusiasm (Asisto a las clases con entusiasmo).	.626
(3) Performance goal orientation		
1	My goal as a teacher is to get promoted (Mi meta como docente es conseguir un ascenso).	.492
2	My goal as a teacher is to be liked by my students (Mi meta como docente es ser querido por mis estudiantes).	.350
3	My goal as a teacher is to reinforce my authority (Mi meta como docente es reforzar mi autoridad).	.783
4	My goal as a teacher is to please the school principal (Mi meta como docente es complacer al director/a de la escuela).	.626
(4) Mastery goal orientation		
1	My goal as a teacher is to improve the learning of my students (Mi meta como docente es mejorar el aprendizaje de mis estudiantes).	.666
2	My goal as a teacher is to develop further in my career (Mi meta como docente es desarrollarme).	.387
3	My goal as a teacher is to better prepare my students for life (Mi meta como docente es preparar mejor a mis estudiantes para la vida).	.878
(5) Self-instruction		
1	I self-manage to use my time effectively (Me autogestiono para utilizar el tiempo de forma eficaz).	.711
2	If the teaching strategies I have used do not work, I use alternative strategies (Si las estrategias de enseñanza que he utilizado no funcionan, utilizo estrategias alternativas).	.744
3	I pay attention to my students' facial expressions during teaching (Presto atención a las expresiones faciales de mis estudiantes durante la enseñanza).	.722
(6) Emotional Control		
1	When a problem occurs during class, I don't panic (Cuando se produce un problema durante la clase, no me asusto).	.780

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Item #	Item name	Factorial loading
2	When a problem arises in class, I first try to calm down (Cuando surge un problema en clase, primero intento calmarme).	.714
3	When I feel bad in a situation, I try to think positive (Cuando me siento mal en una situación, intento pensar positivo)	.690
4	When I encounter a problem, I take a deep breath (Cuando me encuentro con un problema, respiro profundamente).	.562
(7) Self-assessment		
1	I learn from mistakes made in class (Aprendo de los errores cometidos en clases).	.851
2	At the end of the class, I try to determine if I have achieved my goals or not (Al final de la clase, intento determinar si he alcanzado mis objetivos o no).	.361
3	I consider feedback from my students to improve my teaching (Considero los comentarios de mis estudiantes para mejorar mi enseñanza).	.512
4	When I self-assess my performance at the end of an academic period, I compare it with that of previous years (Cuando autoevalúo mi desempeño al final de un periodo académico lo comparo con el de años anteriores).	.442

Table 2
Estimates of the scales in the AFC process

	Scales	X^2	<i>df</i>	RMSEA	(90% CI)	SRMR	CFI	TLI
1	Goal setting	1.704*	2	.000	.000-.132	.014	1.000	1.000
2	Intrinsic interest	1.826*	2	.000	.000 -.135	.032	1.000	1.000
3	Performance goal orientation	.182*	2	.000	.000 -.053	.006	1.000	1.000
4	Mastery goal orientation	.000*	0	.000	.000 -.000	.000	1.000	1.000
5	Self-instruction	.000*	0	.000	.000 -.000	.000	1.000	1.000
6	Emotional Control	.907*	2	.000	.000 -.000	.011	1.000	1.000
7	Self-assessment	3.034*	2	.050	.000 -.157	.027	.985	.954

Notes. *df*: degrees of freedom of the model; RMSEA, root mean square error of approximation (90% CI) 90% confidence interval RMSEA; SRMR, Standardized Square Root of the Residue; CFI, comparative fit index; TLI, non-normalized fit index.

* $p < .05$

To confirm the structure of each scale by means of the CFA, the global fit evaluation for each model was considered. The results in Table 2 indicate that all fit indices met the appropriate criteria suggested in the literature $RMSEA \leq .07$; CFI and TLI > 0.92 and SRMR < 0.08 (Hair et al., 2014). Regarding the results of the reliability estimation of the scales, both methods used (McDonald's ω and Cronbach's α) show an adequate internal consistency ($> .703$; Table 3) (Trizano-Hermosilla & Alvarado, 2016).

Table 3
Scales reliability index

	Scales	McDonald's ω	Cronbach's α
1	Goal setting	.798	.772
2	Intrinsic interest	.713	.703
3	Performance goal orientation	.785	.763
4	Mastery goal orientation	.809	.804
5	Self-instruction	.768	.766
6	Emotional Control	.781	.769
7	Self-assessment	.745	.721

Discussion

The objective of this study was to validate the Spanish language scales to measure the processes involved in teachers' self-regulation and to show evidence of their functionality when applied with technological tools. In this study, self-regulation was defined as teachers' own regulation strategies that they use during classes. To achieve the objective proposed in this research, three stages were implemented consecutively, the first being the back-translation of the scales, the second corresponding to the application of cognitive interviews and finally, the performance of confirmatory factor analysis.

Although initially, nine scales were proposed consistent with a previous instrument in the area of teacher self-regulation, the results of this study show seven scales corresponding to goal setting, intrinsic interest, performance goal orientation, goal orientation domain, self-instruction, emotional control, and self-assessment, which maintained their structure and sufficient items. This procedure is recommended by the relevant literature, which specifies that only the items with the highest factor loads for a given scale should be selected (Morgado et al., 2018). At this point, it is important to point out that although the number of items on the scales is in many cases predetermined by the researchers who published it, this may change in future processes of cultural adaptation, that is, when it is tested on different samples. It is emphasized that enough items per dimension is a prerequisite for psychometric scales, since only multiple items allow internal reliability to be evaluated, this being necessary in psychometrics. A minimum of three items per scale is generally recommended, as this number will reliably produce convergent solutions in confirmatory factor analysis (Robinson, 2018). This recommendation is fulfilled for the seven scales validated in this study, in all cases there were 4 items remaining, apart from the mastery goal orientation scale and the self-instruction scale, which were composed of 3 items.

Regarding the internal consistency coefficients, it was possible to demonstrate that they are optimal according to the specialized literature. These oscillate between $\alpha = .703$ and $\alpha = .804$ (Taber, 2018) and $\omega = .713$ and $\omega = .809$ (Trizano-Hermosilla & Alvarado, 2016). On the other hand, the design of the application is considered a strength of the scales of this study; depending on the purpose of the researchers, it allows, its complete use to measure the process of general regulation of teachers or, to consider only the scales of interest that account for specific regulatory processes whose analysis is sought (Sáez-Delgado et al., 2021).

The production of data is essential for research and although the methodology of the studies may vary, it is essential that these are of quality to be able to analyze and interpret them in a specific context to provide generation of knowledge and make an adequate inference from a sample to better understand a population. Traditionally, the most common methods of data collection have been carried out through the application of surveys, being possible to identify the manual and online types. The manuals are the classic paper and pencil applications where the instrument is printed, it is given to the participant who responds by marking the alternatives that represent their answers with a pencil. In the case of online applications, the instrument is digitized electronically, and it is sent to the participants using new technologies (Nayak & Narayan, 2019).

Among the advantages reported by researchers in online surveys, the following can be mentioned: that it is a faster means of reaching the target audience, it is possible to carry out real-time analysis, they are profitable since no printing of the instruments is required, their margin of error is minimal, easy to answer, they optimize processing time because it is not necessary to type the answers, they are recorded immediately, the respondents may be more honest since the answers go directly to a computer and are not delivered to a third party. On the other hand, disadvantages of online surveys are also described: low response rate, possible doubts to answer in the absence of a surveyor, possible access bias to the survey due to limitations of internet or connectivity and the characteristics of the non-respondents (Evans & Mathur, 2018; Salama et al., 2020; Vaske, 2011). Although the acceptance of online surveys is becoming more frequent and accepted by researchers, due to the aforementioned disadvantages, it is considered that hybrid surveys will become widespread in the future (Evans & Mathur, 2018).

Practical implications for the area of psychometrics, educational psychology and technology are derived from this study. In the first place, scales are made available that quantify the self-regulatory processes of teachers, considering Zimmerman's classic theory of self-regulation that contemplates three phases (preparatory, execution, and self-reflection) (Zimmerman, 2000) where each of them deploy processes. Thus, this study provides seven scales that allow measuring seven regulatory processes on how the teacher regulates teaching. The first phase of high school includes the necessary processes for planning teaching, in this case represented in the categories of goal setting, intrinsic interest, performance goal orientation, mastery goal orientation. The second execution phase includes processes that occur during the action, that is, during the course of the class, in this study it corresponds to the self-instruction and emotional control scales. Finally, the third phase of evaluation includes processes of self-judgment and self-reaction of teachers. In this case, the self-assessment scale was included where the teacher makes a comparison of performance with a standard or goal. Therefore, it is possible to observe that the proposed classes are aligned with the foundations of the social-cognitive theory of educational psychology.

Second, valid and reliable scales are available to measure the regulatory processes of teachers, responding to the need to have instruments for the Latin American region that comply with psychometric recommendations. The regulatory processes of teachers are considered beneficial for the results of their teaching and professional practice, but they are also very relevant to provide models to students regarding the self-regulation variable that is associated with successful academic performance (López-Angulo et al., 2022).

Third, regarding the technological implications, the application of scales that measure psychoeducational processes in teachers in an online application format is evidenced, using a technological tool that offers different benefits when carrying out information gathering and data collection. In this case, a sufficient sample was obtained to confirm the structure of the scales, at low cost, with an attractive format for the participants, comfortable and safe from an ethical point of view, since their data are protected and are not exposed to deliver the physical document to the interviewer. Therefore, the benefits described in the introduction of this study on the application of online scales were confirmed (Duffy et al., 2005; Simmons & Bobo, 2015; Zhang et al., 2017). This offers researchers a view of the experience of using an online survey to measure teacher regulatory processes (Evans & Mathur, 2018).

Within the limitations of this study, there are those related to the participants, since they correspond to secondary school teachers from a specific region of southern Chile. It is desirable that future studies include teachers from other academic levels, such as primary and university education. Likewise, it is interesting that future research can apply these scales in initial teacher training to identify the characteristics regarding teacher self-regulation and, with this, design curricular activities that enhance training in regulatory processes that ensure self-regulated teachers for the exercise of their profession.

Conclusion

Considering that the objective of this research was to adapt and validate scales to measure the self-regulation processes of teachers in Spanish and with evidence of its application functionality through technological tools, it is possible to conclude that: (1) seven valid and reliable scales (Goal setting, Intrinsic interest, Performance goal orientation, Mastery goal orientation, Self-instruction, Emotional control, and Self-assessment) are made available for research, which measure self-regulatory processes in secondary school teachers; and (2) these scales are of great value to researchers seeking to improve teaching practices regarding cognitive motivational variables, in this case, from self-regulation theory.

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