Self-Regulated Learning of Statistics and Tics Integration in University Students

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Abstracts: The objective of the research was to determine the level of relationship between self-regulated learning of statistics and tics integration in university students. The methodology was non-experimental, quantitative, correlational, and cross-sectional, at a single point in time. A non-probabilistic, non-random, convenience sampling was used. Then, using the snowball technique, the instrument was applied to a total of 433 students, to whom a questionnaire validated with Cronbach's alpha was applied as an instrument, with 39 questions on a Likert scale measuring the variables self-regulated learning and integration of information and communication technologies, with the dimensions: planning, self-regulation, self-assessment and proactive incorporation, motivation, and competences, respectively. It is concluded of the total inferential analysis, that there are significant differences in the average values of the analysis since planning is among the moderately high levels while in the other dimensions the values do not reach the total high value determined in the measurement scale, which indicates the need to instruct in this phase to improve the integration of self-regulated learning. Spearman's correlation coefficient at a significance level of 0.01 shows a value of 0.828. These results allowed concluding that there is a positive and statistically significant relationship for the level of self-regulated learning and integration of information and communication technologies as variables. In addition, when analyzing the percentage levels as a result, it was obtained that in the self-planning dimension there is 82% in the advanced level, in the variable integration of information and communication technologies and its dimension proactive incorporation it was also reached in an advanced level 81.1%, likewise it can be mentioned that in the results it was obtained in the integration of information and communication technologies an advanced level of 81.1% which are the results of the virtual classes taken as a strategy in education and bringing strengths in the new approach to education.

Keywords: Self-Regulated Learning, Technology Integration, Cronbach's Alpha.

1. INTRODUCTION

The education approach is focused on the learner, using in its own way the available digital resources effectively to support the formative experience and thus obtain solutions to a comprehensive need. Digital transformation, simplification, modernization, and digital citizenship literacy is one of the mandates directed by Summit of the Americas (Regional Agenda for Digital Transformation, 2022).

While quality and lifelong learning are hardly searched (World Bank, 2020). This lifelong learning seeks to develop educational approaches based on problem solving, collaboration and adaptability. The aspect of adaptability is relevant to use it in education during the end of a pandemic where many students adapted to online distance learning, adjusting platform learning using live streaming by the teacher and video-based learning by the students.

The World Bank (2022) considers that information technologies play a crucial role in supporting teachers and students facilitating the process of communication, access to content, data, and networks, helping educators to adapt their educational training practices for improvement.

Unesco (2016), guarantees education from a humanistic point of view where there is no student left without studies or vocational training, in other words, promoting learning at all levels or education as stated in the SDG.

The use of digital tools and resources is increased by the search for information and autonomous learning that helps to meet the needs of their school and professional lives, which constitutes a trend of alternative and highly effective learning (Padilla et al.,2020), making each student an autonomous learner moved by the new paradigm of technologies.

The integration of technologies in student training is the application of digital tools in an effective way whose functionalities offer personalization and self-development acquired by each student (Guerrero,2023), during the period of technologies inhabited from home and even with the development of new forms or approaches to make semi face-to-face and face-to-face classes as referred to (Manco-Chávez, 2020), all this leads to flexibility and different ways of learning linked to cognitive engagement, resource management and motivational belief domains, mediated by a computer with an internet connectivity.

It is necessary to achieve within the learning and training of university students the improvement of the educational quality and one of the proposals framed in the research is that it is a self-regulated learning as mentioned (León et al.,2022), and that these conditions generate new knowledge capable of making each student reach new ones (Ramírez, et al.,2022), and then to generate scientific knowledge production, due to the competences acquired as individual learning, making each student achieving it.

The impact caused by the pandemic and its effects is a concern topic in the educational field (Adrianzén & Chilón,2021) and has uncovered the importance of autonomy, self-organization, self-regulation and self-discipline in the learning process, adopting strategies that involve students' metacognitive skills (Albani et al.,2023), life learning in new knowledge development taking as a basis the use of databases that deliver useful information when there is statistical analysis.

In this way (Queiruga et al.,2021), mention that university entities and basic education training centers rely on pedagogical models like the case of self-regulated learning (Adrianzén et al.,2021), in virtual and face-to-face classrooms capable of making students able to produce materials according to the needs of the study centers, which within the studies of (García & Peña,2021), mention that this type of model has a positive effect in learning.

The Covid 19 crisis managed to make possible students became autonomous (Cruz, 2023), and with their own control of learning mediated totally by computer and virtually, with a synchronous and asynchronous teaching (Ramírez et al.,2022). It is evident that self-regulated learning is valued by each of the individual beings who seek to achieve autonomous learning.

The problematic reality found in the university institution where the instrument has been applied shows that despite the new approaches and paradigms produced during a pandemic to make education and students continue with their professional training, many students have not reached satisfactory knowledge in the virtual tools management, this makes the investigation an interesting topic, also during the process of bringing the guided teaching through face-to-face and virtuality on the integration of technologies that help to improve the learning of statistics.

The research is methodologically justified in the self-regulated learning (Miná et al.,2021), of statistics through the integration of technologies being viable due to students have equipment such as laptops, tables and other devices that help to have a learning based on technological tools, likewise we can see that this new way of doing education has allowed students to develop new skills.

There are many models that measure self-regulated learning (Maliza, 2023), as is the case of MSQL (The motivated strategies for learning questionnaire as mentioned (Curione et al.,2022), allowing measuring the degree of learning, according to the factorial statistics, it brings relevant and adequate information to the process of autonomous learning that is of interest in each course, especially the one of statistics raised within this research,

likewise it demonstrates that this strategy is shown from childhood in age at school and in universities as mentioned by (Del-Moral et al.,2022), promoting the realization of an experience given to school-age students achieving through this research something significant in order to help improving their learning, regardless of the gender of the person within their academic training.

When investigating about the resources used in self-regulated learning employed by the teacher, students show a great appreciation for: blogs, virtual learning environments, infographics, rubrics, and gamified questionnaires, since these allow enhancing the student's autonomous learning (Tur et al.,2022). There are statistics that predict 33.7% of teaching practices that promote self-regulated learning (Sáez-Delgado et al., 2022), therefore it is considered necessary to propose methods of greater application in this type of learning.

It is also important to note that self-regulated learning (Carbajal et al.,2023), can be adapted by the student and taught by teachers in private and public institutions so that everyone can achieve an equitable and quality education with satisfactory competences for a good work environment (Zambrano et al., 2020).

On the other hand, there is an important and significant point (Valerio et al.,2023), to achieve an equitable education which indicates that students at the educational level appreciate academic improvements (Delgado et al.,2018). The ability to manage time and study space increases in the seventh and ninth cycle relating this to the maturity level of students and thus improving the values of their evaluated activities (Angulo & Ramírez, 2020). It is important to emphasize that by using attractive resources such as augmented reality, students achieve better performance in their activities and greater motivation to fulfill them, university students through augmented reality objects, especially if they generate these objects or if they use previously produced objects show a high degree of acceptance and motivation (Barroso-Osuna et al.,2018).

For Vigotsky (Ramírez et al.,2022), education develops in the process of time. Under this perspective, it is assumed that thinking is about the interconnection between the different areas of knowledge, giving meaning to knowledge. In this sense, self-regulated learning as a construct manage to develop itself through various constructs and approaches that help to improve learning. In this order of ideas, lifelong learning starts from the learners personally who, through self-regulation processes, initiate their own preparation.

In consideration of the above, it should be noted that in this pre- and post-pandemic era (Beteta et al., 2023), learners have assumed their own autonomy for their development and educational institutions have lost their monopoly as the only place for learning and using technologies (Ocaña-Fernández et al.,2020), it offers immense possibilities compared to traditional education, bringing greater scope of information (Forero-Arango et al.,2023) to link new knowledge with what was previously learned and to clarify its importance in relation to the information already understood; thus demonstrating the process of self-regulation.

Autonomous learning is therefore a process where the student self-regulates the own learning and becomes aware of his/her own cognitive and socio-affective processes (Crispín et asl.,2011). In this sense, the process made by the student requires a humanistic and participatory training that encourages leadership, decision making and promotes autonomy, as well as analytical-reflective thinking. In this way, (Valdés et al.,2022) state that Vygotsky conceptualized self-regulated learning as a social process that involves the educational community, the strategies and resources used in learning (Martínez-Sánchez et al.,2022).

Therefore, self-regulated learning is defined as an organization of cognitive and behavioral activities where the student configures the own activities and organized the environment to meet the objectives (De Ávila, 2020).

Likewise, self-regulated learning is specified as a metacognitive behavior that empowers students to active functional skills to the development of school activities and cannot be conceived as a single construct (Del-Moral et al.,2022) and (Angulo & Ramírez, 2020), through this learning the student exercises autonomy to plan, monitor and control their thoughts, feelings, and behaviors. Valuable in different contexts "master" deployed. It is an important capacity or an operational tool to achieve the quality of teaching. In this sense, learning is the result of a personal learning system's own process that you can improve step by step.

Also (Miná & Otero,2021), show that self-regulated learning are contributions delivered by Zimmerman and Pincrich that show in their models the ability to understand within the learning processes, according to the thinking, feelings, motivations, and facts or actions that allow the development of meaningful learning (Angulo & Ramírez,2020), in students due to the development of academic strategies as a resource for their learning (Melo et al.,2020), such as technologies, computers or digital tools to close the information gaps through the internet where there is much more to produce with new alternatives and academic approaches.

Self-regulated learning in education shows to be significant in the improvement of learning according to (Pinochet-Quiroz et al.,2022), the hypotheses established in the research, being a quantitative analysis and approach that shows that self-regulated learning in the formation of any course, as is the statistics course that shows an improved performance as a mediator of new learning of statistics in the case of this research. For that reason, to reach the optimal level, they define the students who self-regulate their learning, around two axes: will and skill, and declare that they usually have a wide previous knowledge, know how to create favorable learning environments, and present a set of adaptive motivational beliefs. In addition, they plan, manage time and effort, and apply a set of cognitive strategies aimed at the achievement of academic activities and their personal goals (metacognition), which make high-performing students.

(Valero, 2022) defines self-regulated learning as the strategies where the student exercises autonomy of his or her own academic training according to the needs through personal motivation and becomes aware of the cognitive and socio-affective development that empowers them to activate the skills in planning, monitoring and control the learning and metacognitive skills for the creation of learning. Thus, self-regulated learning should take place under the following conditions: self-planning, self-regulation, and self-assessment.

Self-assessment according to (Valero, 2022) and (Mendivel et al.,2020), self-assessment and self-regulation are linked to the cognitive capacity of self-measurement that allows students to examine their aptitudes and reorient them to a process of continuous training adapted (Carrión et al.,2022), by the changes of today's society including learning styles and strategies, socializing, and communicating in the classroom. Self-planning states that it corresponds to identify the proposed learning objectives, with the purpose of coordinating a set of strategies linked to motivation where students define and decide their learning path to learn and executes self-regulation activities to obtain the learning results.

Therefore, it should be noted that the use of technologies united with self-regulated learning processes require considerable planning and direction to optimize the learning processes for students and at the same time to be guided by the tutor to make students established at an optimal level. Hence (Díez, 2020) and (Arriagada et al., 2019), emphasize that one of the important challenges in education is to preserve and strength the management and implementation of tools that help to improve the different didactic processes through the correct use of information and communication technologies. On the other hand, it should be noted that there have been dizzy changes taking place in information and communication technologies, manifesting in trends towards globalization, generation, and expansion of knowledge, since a virtual education network is being created and implemented (Ricardo & Vieira, 2022).

In this sense, (Hernández, 2018) and (Laderas et al.,2022), state that ICT are modernizing society, and in particular educational processes; where digital networks are part of this social change, taking also into account, the existence of many adjuvant technologies, which are a reflection that we are living in a generation integrated to changes and transformations. (Valero Palomino, 2022), (Melo, 2020), states that the potentialities contribute to students in achieving good academic performance and in university academic training are: proactive incorporation, motivation, and competence. These are detailed below.

2. METHODOLOGY

During the research it will count with results using test or items in which students will answer so then the entire database will be statistically processed, responding to the hypotheses and formulation of the general problems as

the specific ones, likewise for the objectives of this research for being developed the conceptual framework with the methodology of (Hernández-Sampieri y Mendoza, p.4 -7, 2018).

The research referred by Tamayo (2012), is of basic correlational type of quantitative and transversal approach applied at a single moment including the items or questions to be answered by the population as mentioned by (Hernández-Sampieri & Mendoza, p.109, 2018), being the results strictly taken with the aim of not being manipulated by any external agent or statistical biases to present a reliable result taken in the population of 433 students who responded to the surveys or items, it should be noted that it is necessary to promote the care of the data for their good search for information in the results and necessarily provide us with research and helping others can develop the research model for the improvement of the course of statistics.

For the presentation of the results, the scores of the self-regulated learning of statistics and ICTs integration will be assumed, which then proceeded to the transformation by levels to the data obtained after the field work.

Table 1 *Frequency distribution by level of integration in university students.*

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
	ICT Integration				
Valid	Intermediate	75	17,3	17,3	17,3
	Advanced	358	82,7	82,7	100,0
	Total	433	100,0	100,0	
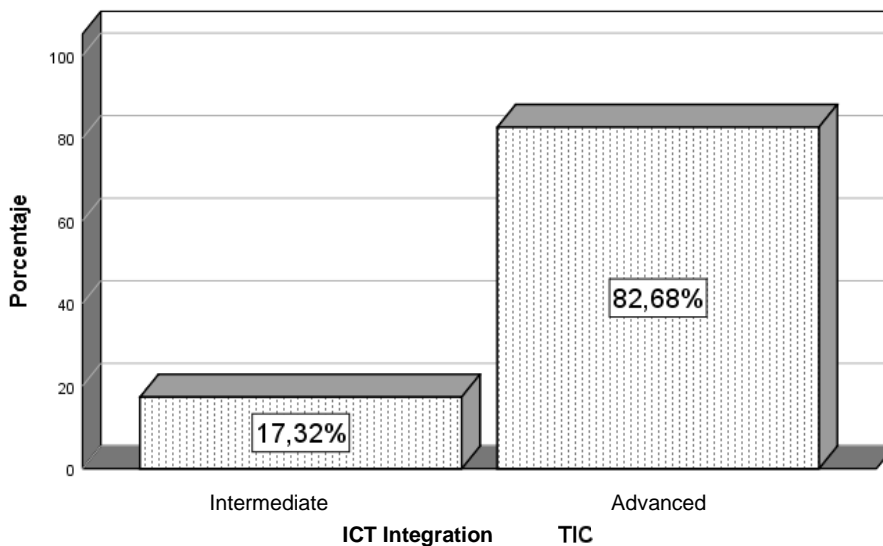
Image 1. Percentage levels of ICT integration in university students.

The results shown in the table and figure identify the levels of ICT integration in university students, where 17.32% are at an intermediate level in terms of ICT integration and 82.68% are at an advanced level of ICT integration in university students.

Table 2

Correlation between the variables self-regulated learning and integration of information and communication technologies.

Analysis for: Determine the extent to which self-regulated learning of statistics and integration of information and communication technologies have an impact on university students.

Table 2 shows the results of the correlation between learning and integration.

Correlation coefficient	Dimension/ Variable	Coefficient/Significance	learning	integration
Spearman's Rho	learning	Correlation coefficient	1,000	,828[**]
		Sig. (bilateral)	.	,000
		N	433	433
	integration	Correlation coefficient	,828[**]	1,000
		Sig. (bilateral)	,000	.
		N	433	433
**. The correlation is significant at the 0,01 level (bilateral).				

Table 3 Correlation between the planning dimension and the integration variable

Correlation coefficient	Dimension/ Variable	Coefficient/Significance	learning	integration
Spearman's Rho	planning (dimension)	Correlation coefficient	1,000	,693[**]
		Sig. (bilateral)	.	,001
		N	433	433
	ICTs integration (variable)	Correlation coefficient	,693[**]	1,000
		Sig. (bilateral)	,001	.
		N	433	433
**. The correlation is significant at the 0,01 level (bilateral).				

Table 4 Correlation between the self-assessment dimension and the information and communication technologies integration variable.

Correlation coefficient	Dimension/ Variable	Coefficient/Significance	self-assessment	integration
Spearman's Rho	self-assessment (dimension)	Correlation coefficient	1,000	,778[**]
		Sig. (bilateral)	.	,001
		N	433	433
	ICTs integration	Correlation coefficient	,778[**]	1,000

	(variable)	Sig. (bilateral)	,001	.
		N	433	433

**. The correlation is significant at the 0,01 level (bilateral).

Table 5 Frequency distribution by level of the variable integration of information and communication technologies

ICT Integration

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Intermediate	75	17,3	17,3	17,3
	Advanced	358	82,7	82,7	100,0
	Total	433	100,0	100,0	

Table 6 Dimensions level of the integration of information and communication technologies

Proactive incorportation		Motivation		Competences	
Frequenc	Percenta	Frequenc	Percenta	Frequenc	Percenta
82	18.9	84	19.4	80	18.5
351	81.1	349	80.6	353	81.5
433	100.0	433	100.0	433	100.0
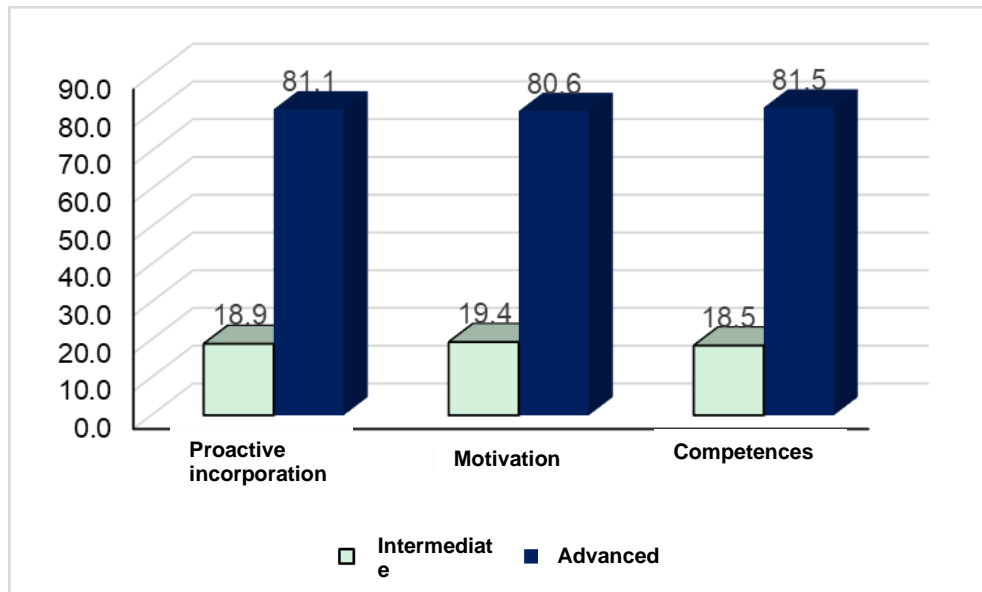
Image 2. Percentage levels of the dimensions of information and communication technologies integration

Regarding the levels of the dimension of the integration of information and communication technologies in university students, the proactive incorporation dimension presents 18.9% versus 81.1% are at advanced level,

likewise in the motivation dimension 19.4% are at intermediate level, while 80.6% at advanced level, finally in the competences dimension 18.5% are at intermediate level and 81.5% are at advanced level in university students.

Table 7 Distribution of frequencies by level of the variable self-regulated learning

Self-regulated learning

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Intermediate	74	17,1	17,1	17,1
	Advanced	359	82,9	82,9	100,0
	Total	433	100,0	100,0	
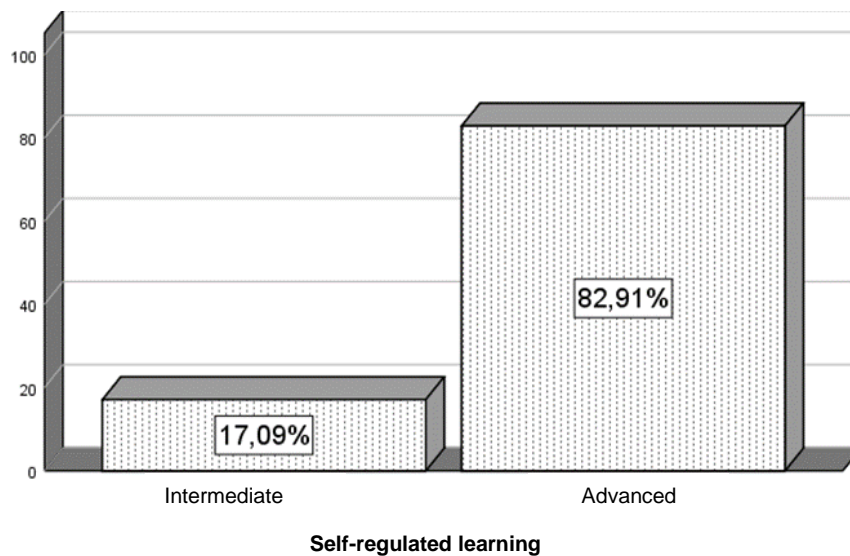
Image 3. Percentage levels of the variable self-regulated learning

According to the level of self-regulated learning of statistics in university students, 17.09% of the students are at an intermediate level and 82.91% are at an advanced level.

Table 7 Level of the self-regulated learning variable dimensions

Self-planning		Self-regulation		Self-assessment	
Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
77	17.8	78	18.0	79	18.2
356	82.2	355	82.0	354	81.8
433	100.0	433	100.0	433	100.0

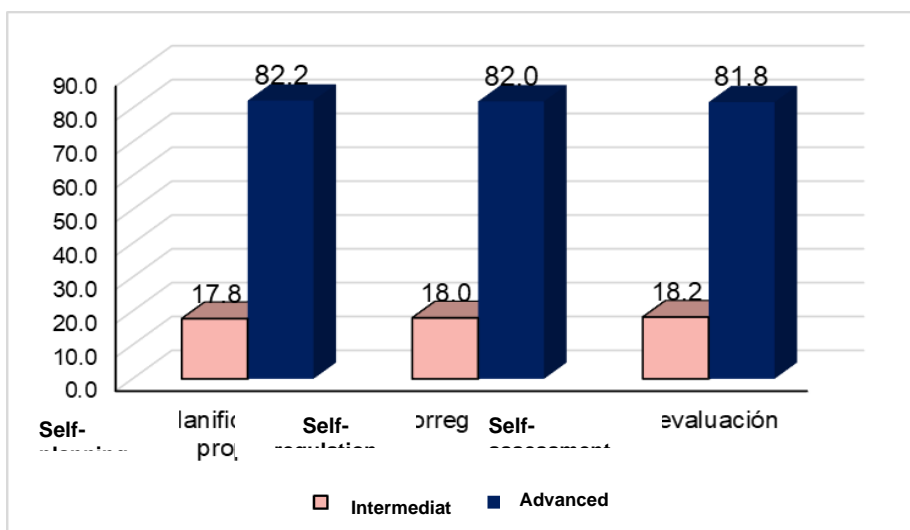**Image 4.** Percentage levels of the dimensions of self-regulated learning

According to the levels of the dimensions of self-regulated learning of statistics, 17.8% of the students are at intermediate level and 82.2% are at advanced level, while in the self-regulation dimension 18% of the students are at intermediate level and 82% are at advanced level, finally in the self-assessment dimension 18.2% of the students are at intermediate level and 81.8% are at advanced level of statistics in university students.

3. DISCUSSION

In the results obtained from this research, it is possible to obtain a theoretical support that allows verifying the general objective: "To determine the level of relationship between self-regulated learning of statistics and the integration of information and communication technologies in university students". In this objective it is positively corroborated that it seeks to develop their learning potential through access to quality education and lifelong learning (World Bank, 2020)., however, in the statistical averages calculated, values between 3.99-4 and 4-5 are reached, therefore, none of the dimensions achieved in tis totally the value 5 that represents the high category when following the measurement scale of table 18. If it is supported that we are in search of an equitable and quality education for all in the world, then we rely on authors such as (Queiruga et al.,2021, Adrianzén et al.,2021, García & Peña,2021), whom agree with the purpose of education seeking students capable of producing materials and at the same time exercising autonomy to plan, monitor and control their thoughts, feelings and behaviors (Angulo & Ramírez, 2020).

According to the results obtained, the average value of the variable self-regulated learning presents a value equal to 4.1620, being this in the high category (4-5) continuing the measurement scale, so it was demonstrated that self-regulated learning is used and influences positively in the formation of students, this agrees with the theories presented by (Zambrano et al., 2020), whom affirm that self-regulated learning can be adapted by the student and taught by teachers in private and state institutions so that everyone can achieve the same education with satisfactory competences for a good work environment. Also (Laderas et al.,2022) and (Adrianzén et al.,2021), made research to establish the relationship between self-regulated learning and academic performance, concluding that there is a positive and significant relationship for the level of self-regulated learning, therefore, this is consistent with this investigation where it was shown that self-regulated learning improves and positively influences learning.

Organizing the ideas, the percentages of the levels of ICT integration in university students show that 17.32% are at an intermediate level and 82.68% at an advanced level, and in reference to the level of self-regulated learning 17.09% of the students are at an intermediate level while 82.91% are at and advanced level. It is emphasized that levels in their totality do not represent 100% at the advanced level, which would be the optimal value to represent education in our society, therefore, as stated by (Díez, 2020) one of the important challenges in

education is to preserve and strengthen the management and implementation of tools that help to improve the different didactic processes through the correct use of information and communication technologies.

The planning dimension and its incidence with ICT was calculated with a correlation value equal to 693, begin found this between a considerable positive correlation, demonstrating that by using planning with technologies we will have a positive increase in favor of education. If we support this result with the research theory of (Tur et al., 2022), in their findings confirmed the existence of a positive relationship between cognitive engagement, resource management and motivational beliefs, domains of self-regulated learning strategies and learning performance. Therefore, in our study we can state that resource management and planning are represented as a positive contribution to education when using ICT.

Finally, for the self-assessment dimension, and its impact with information and communication technologies, a value equal to 778 was calculated, being this between a medium positive correlation and a significant positive correlation. In this way, the researchers (Mendivel et al.,2020) conclude in their study that in the self-regulated learning of students, learning to learn, mastering the career specific learnings, using computer and technological resources positively strengthens their training, and to achieve them, students submit their activities to self-assessments that allow them to improve and overcome in their student training. Thus, this study agrees with what has been demonstrated in our research, since self-assessment, information and communication technologies allow students to examine their own aptitude and reorient themselves to a process of continuous training linked to cognitive capacity (Valero, 2022).

CONCLUSIONS

In self-regulated learning can be observed, according to the results, the great contribution of this method, making students achieving significant learning and thus, for each dimension of the self-regulated learning variable; it shows a high level of acceptance and manipulation by the students that make them competent students, and this implies the strong relationship that exists with the integration of ICT in the immediate use of them for a better understanding in the statistics course.

Considering the Spearman's Rho correlation for self-regulated learning and the integration of information and communication technologies measured in third and fourth cycle statistics students at the Universidad Autónoma del Perú, it is concluded that there is a positive mean relationship (R: 0.822). This is important for the learning strategies that the teacher and the student should implement, since self-regulation allows the student to develop with autonomy to plan, monitor and control their thoughts, feelings, and behaviors (Angulo & Ramírez, 2020).

Regarding the Spearman's Rho correlation for all dimensions (planning, self-regulation, self-assessment, incorporation, motivation, and competences) measured with the instrument, it is concluded that there are high positive correlations (R: 0.7 – 0.89) and (R: 0.9 – 0.99). These results imply that self-regulated learning can be used by students and taught by teachers (Zambrano et al., 2020) in the institutions so that everyone can achieve an equitable education and satisfactory competences for a good working environment.

Considering that the variables and dimensions are in the advanced level averages (3-3.99) and in a very advanced level (4-5) it is demonstrated that these processes have been used and should be improved in their instruction for students and teachers to be able to count on the improvement of the educational levels.

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