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Validating the process for labeling Moodle activities according to Complex thinking theory

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Abstract. *This study proposes and evaluates Moodle activities labeling according to the abilities related to the subject's cognitive aspect, punctuated by the complex thinking theory. The labeling's qualitative character consisted of 30 educators' responses from a federal institution to a form, aiming to relate skills to activities. The conceptual analysis of the labeling process and the grouping of responses from the form composed the quantitative labeling factor, resulting in reliable labeling. Comparisons between this labeling and a previous one highlighted similarities and discoveries. This labeling makes it possible to identify significant student characteristics presented by this theory and, consequently, the use of pedagogical activities that explore and expand higher-order skills.*

1. Introduction

In the rapidly evolving landscape of digital technologies, such as e-learning and blended learning, traditional teaching methods struggle to meet personalized demands, including interactivity, non-linearity, and virtual reality, engage learners effectively [Silva 2010]. To address this challenge, complex thinking theory [Morin et al. 1994, Morin 2003] provides a theoretical foundation for understanding the teaching-learning process, particularly in distance education settings.

Complex thinking characteristics offer valuable insights for educators to enhance the effectiveness of their courses in promoting specific skills. This information empowers them to improve instructional design and teaching practices, ultimately fostering the development of complex thinking skills in students. Furthermore, students benefit from the labeled activities as it provides them with a clearer understanding of how each activity contributes to their complex thinking skill development.

An approach to promote such skills supposes to identify which virtual pedagogical actions or activities can cope with these skills. That means it is necessary to establish a relationship between actions and skills by proposing a method to label activities with skills. Moreover, labeling activities based on complex thinking characteristics supports the cultivation of metacognitive skills in students, preparing them for effective learning and problem-solving [Hmelo-Silver 2004]. By being aware of the specific complex thinking skills required for each activity, students can reflect on their learning processes and identify areas for improvement. This approach to labeling activities promotes a

student-centered learning environment by emphasizing the significance of complex thinking skills. Educators can encourage students being active in their learning and engage in self-directed learning activities [Deci and Ryan 2000].

Considering the demands teaching-learning process focused on e-learning, this article describes the process of labeling Moodle activities based on complex thinking theory, explaining how activities were selected and clustered according to students' characteristics. The results of the labeling process are evaluated, demonstrating the agreement between the applied method and the labeling conducted by experienced educators.

The remainder of this paper is organized as follows: Section 2 provides background information relevant to this study, while Section 3 presents related works. Section 4 describes the methodology employed, explaining the process followed. Section 5 present the results concerning the distribution of complex subject characteristics across different Moodle activities. Finally, in Section 6, we conclude and outline directions for future research.

2. Background

Aiming to develop higher-order cognitive skills essential for effective learning, complex thinking theory has been extensively employed in instructional design and e-learning. This section presents this theory and its relationship with these areas.

As a theoretical framework that explores the nature and the processes of thinking within complex systems, the complex thinking theory recognizes that phenomena in the world are interconnected and involve multiple layers of interactions and interdependencies [Morin et al. 1994]. This theory delves into how individuals engage with complex systems, problems, and situations, emphasizing cognitive skills such as analysis, synthesis, evaluation, and creativity, which are intertwined with affective, social, and metacognitive factors. In addition, it underscores the importance of educational experiences that foster the development of these cognitive skills [Bransford et al. 2000], such as problem-based learning, inquiry-based learning, and constructivist teaching approaches that encourage students to tackle real-world complexities and devise solutions. Metacognitive skills, including self-regulated learning, are highlighted as essential for effectiveness complex thinking, with instructional strategies like goal setting, monitoring, and reflection aiding students in regulating their thought processes and enhancing performance on complex tasks [Griffin et al. 2019].

In the educational context, it is crucial to highlight the actors being part of this scenario, and the student plays an important role. The complex subject refers to the student as an individual with multifaceted cognitive abilities and capacities who is not a passive recipient of knowledge but an active participant in the learning process [Morin 2003]. The relationship between complex thinking theory and the complex subject lies in the understanding that learning is a complex cognitive process that involves various interconnected skills and competencies. Complex thinking theory provides a framework to analyze and characterize cognitive abilities, problem-solving skills, critical thinking skills, creativity, metacognition, and other higher-order thinking skills (HOTS) that are essential for the development of the complex subject [Morin 2005]. Maissiat [Maissiat 2013] deemed metacognition, resilience, autonomy, subjectivization, creativity, transdisciplinarity, affectivity, cooperation, and flexibility necessary for complex subject formation in

e-learning environments, considering complex thinking theory and independent characteristics.

The complex subject description through the complex thinking theory allows educators and researchers to identify whose specific skills and competencies students need to acquire and develop. Hence, the selection of activities able to provide such skills can improve the instructional design and teaching strategies in educational platforms. Then, it is necessary to associate skills with activities, which is the goal of this study.

Labeling Moodle activities based on complex thinking characteristics allows educators to align the learning objectives of the activities with the desired development of complex thinking skills in students [Campos 2011]. It helps create a more focused and intentional learning environment where students can engage in activities that promote and enhance their complex thinking abilities.

As recommender systems determine practices in teaching-learning processes [Dziob et al. 2018], the characteristics and pedagogical actions (Table 1) from Maissiat's work are suitable since they proposed a constant set of skills attributed to Moodle activities. Although from Morin's conceptual perspectives [Pacheco and Herrera 2021], there are no systems or instruments for evaluating complex thinking, if Moodle's activities allow for identifying higher-order cognitive aspects, it can be significant to develop a recommender system based on complex thinking theory.

Table 1. Characteristics of the Complex Subject X Pedagogical Action

Characteristic	Definition [Morin et al. 1994]	Pedagogical Action [Maissiat 2013]
Resilience	Possibility to react positively to adverse situations	Verify the resolution of similar activities when the student fails in some content
Autonomy	Go beyond what is established and proposed	Verify sequence of access to activities; time management to solve them and extra activities performed
Cooperation	Feeling part of a whole with the participation of other people, making work more productive	Analysis of the execution time of group activities, comparing this time with the execution of individual tasks; Evaluate content sharing, requests for help in forums and chats
Metacognition	Development of the ability to learn how to learn	Evaluation of the history of activities answered by the student, identifying their predilections
Transdisciplinarity	Observing that concepts and contents can be connected and thus worked on.	Evaluate content citations between different activity modules
Creativity	Carry out activities with other perspectives and practices	Evaluate the student's activity history, verifying the diversity of activities resolved
Flexibility	Carrying out activities at their own pace and speed, achieving objectives with varied amplitude	Time management to solve activities, schedules, locations, and access devices

Overall, complex thinking theory provides a basis for understanding the complex nature of learning and the interconnection among cognitive skills. Moreover, it emphasizes the importance of fostering the development of complex thinking skills for the complex subject. Therefore, the pedagogical actions identified by Maissiat (2013) related to Morin's theory underlined the characteristics of the complex subject in the student and are suitable for labeling activities.

3. Related Works

According to this study's purpose, the literature review concentrated on works that included the keywords complex thinking, Moodle, labeling, and activities. The main observations were that most of the work used some of Moodle's activities without concerns linking them to specific high-order skills. On the other hand, when the proposal presented the linking, only one activity was considered. However, Maissiat (2013) has argument this is not enough to characterize an individual as a complex subject.

As public wiki has the potential to positively impact writing skills, awareness of intellectual property, processing and understanding of content, interaction among students, and the development of critical thinking skills [Matthew et al. 2009], the work from [Bravo and Young 2011] is an example where HOTS was considered without an explicit linkage. This work explored students' perceptions and behaviors of public WIKI use during a collaborative Wikipedia assignment in a technology course. They listed ways to use Wikipedia to promote HOTS. For example, WIKI can teach students to evaluate online resources critically. [Rowe 2012, Cabiness et al. 2013] considered using WIKI mainly to develop collaboration skills.

[Schoenberger and Liming 2001] presented a program for enhancing mathematical thinking skills through mathematics vocabulary and numerical operation that included an ODDE (Own words, Draw, Do work, Explain) problem-solving system for providing a **FORUM** where the students practiced their metacognitive, communicative, and social skills. Differently from those works that used **WIKI**, this was the first one that linked some specific characteristics to an activity. [Fernando 2020] discussed **QUIZZ** from Moodle since it offered possibilities to develop and assess academic writing. Concerned formative writing assessment, **QUIZZ** stimulated student autonomy and self-regulation and was mainly desirable in longer tasks requiring a structured written output. This work linked **autonomy** skill to a specific Moodle activity.

[Maissiat 2013] organized a continuing education course in a virtual learning environment to observe how occurred the manifestation of complex subject skills, and through questions that sought an investigative and creative attitude from the course participants, analyzed their perception of the answers publicized in Moodle tools (Forum, WIKI, Assign, Chat). After manual analysis of these answers and considering their subjectivity, elements of the theory of complex thinking were pointed out, as well as the pedagogical actions necessary to motivate them.

These studies stimulated HOTS development, but any put together creative thinking, critical thinking, and metacognition. As the students should hold a list of skills at the end of the program/subject, the instructional design can indicate the best way to achieve them [Saraiva 2021]. [Apino and Retnawati 2017, Ezz Elarab and Maddy 2021, Loewen 1995] emphasized the importance of instructional design in developing HOTS but superficially considered the critical or creative thinking, failing to capture the student's complex nature as a subject. Therefore, the conceptual model that establishes the relationship between these three dimensions is relevant and it is a higher cognitive process that forms complex thinking [Pacheco and Herrera 2021].

As noted, any previous research proposed to label Moodle activities taking into account the complex subject or thinking. However, [Maissiat 2013] demonstrated the ne-

cessity for several activities to develop the characteristics of the complex subject. Moreover, [Maissiat 2013] proposed a set of pedagogical actions and linked them to the complex subject. Maissiat's conclusions inspired the initial labeling of Moodle activities [Oliveira et al. 2022].

4. Labeling Methodology

This work is an extension of the labeling proposed by [Oliveira et al. 2022], whose basis was only the definitions of the complex subject, descriptions of Moodle's activities, and Maissiat's work. As this task contains a high subjectivity factor, this work extends and improves the labeling process, since it considers 30 educators (specialists) whose Moodle's experience ranged from 2 to 15 years. Above 50% have worked in Distance Education for more than nine years. Their areas of expertise permeate the technical, higher, and postgraduate levels, but most work at the higher level, mainly in the exact science area (60%). At least 1/3 of these professionals taught almost all classes of a given course, from the first to the last period. This diversity reflected the complexity and scope of Distance Education and demonstrated the quality of experts to describe the relationship between Moodle's activities and the complex subject. Firstly, the educators labeled the most used Moodle activities by following the methodology from [Oliveira et al. 2022]. After, a statistical analysis and clustering aggregated their opinions in reliable labeling.

4.1. Labeling Moodle Activities

[Oliveira et al. 2022] proposed a guide for the labeling process which consisted of definitions of the Moodle activities and the complex subject, as well as the correlation between the characteristics of the complex subject and the pedagogical actions from [Maissiat 2013] (Table 1). Moreover, it was considered that an individual with knowledge assumes the role of a specialist [Lindsey et al. 2014] to label a certain activity on that subject .

The labeling process was for finding connections between Moodle activities (Glossary, Database, Chat, Choice, Forum, Workshop, Lesson, and Wiki) and the characteristics of the complex subject (Resilience, Autonomy, Cooperation, Metacognition, Transdisciplinarity, Creativity, and Flexibility), and followed the steps below:

1. Extract the relevant verbs, synonyms, and adjectives from the definition of each activity and the respective educational objectives
2. Compare the results from the previous step and the characteristics' definitions.
3. Verify which pedagogical actions (Table 1) can enclose the activity.

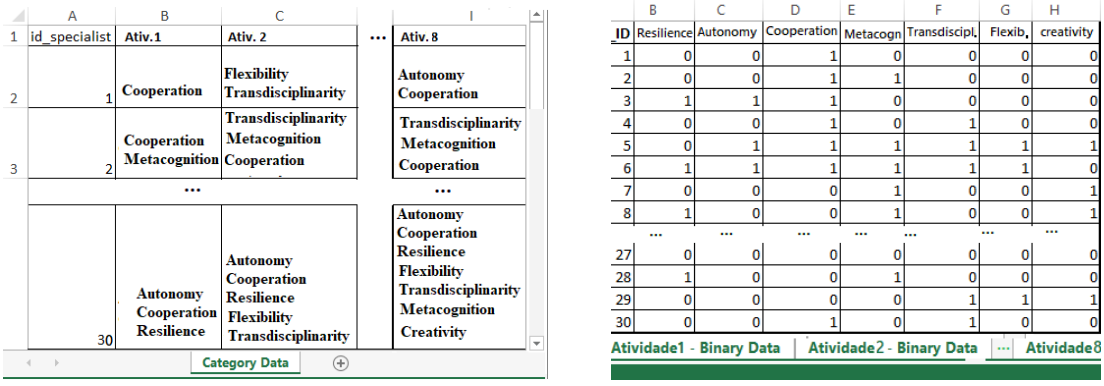
As Massiat's correlation used pedagogical actions which can be performed by different activities, but it aids to confirm the possible association identified in the second step. Then, this process found out which characteristics could be enhanced by each activity. This qualitative process required conceptual analysis and interpretation of concepts to establish criteria for labeling activities. However, to make this result acceptable and reliable, 30 educators were invited to answer a form that resumes this process and allows for collecting their perceptions regarding the relationship between these activities and characteristics. Then, the next stage was to abstract a unique labeling able to capture the essential aspects of these 30 answers.

4.2. Applying the labeling

The main contribution of this article is to evaluate the labeling of activities according to the mentioned method, by means of statistics and clustering techniques to find congruences among the specialists and [Oliveira et al. 2022]. A Google Form[1] was applied to the thirty educators (specialists), which was composed of the activities' descriptions, characteristics' definitions, Table 1, and the following question for each activity *Considering the <activity name> description, select one or more labels, in order of priority, that you believe present the characteristic(s)*.Before answering the form, the respondents knew the above process since it was driving the answers.

The labeling conducted by the specialists resulted in a dataset containing categorization data, as shown in Figure 1(a). Clustering is an alternative viable to realize unique labeling in this case. However, firstly, it was necessary to convert this categorical data into binary one, as illustrated in Figure 1(b), where the values 0 or 1 indicate the absence or presence of a category, respectively.

Preprocessing of the categorical variables allows for a better understanding and extraction of valuable information from the data [Möbius 2021]. The performance of a machine learning model depends not only on the model and hyperparameters but also on how variables of different types are processed and fed into the model.



	A	B	C	...	I
1	id_specialist	Ativ.1	Ativ. 2	...	Ativ. 8
2	1	Cooperation	Flexibility Transdisciplinarity		Autonomy Cooperation
3	2	Cooperation Metacognition	Transdisciplinarity Metacognition Cooperation		Transdisciplinarity Metacognition Cooperation
	...				
	30	Autonomy Cooperation Resilience	Autonomy Cooperation Resilience Flexibility Transdisciplinarity		Autonomy Cooperation Resilience Flexibility Transdisciplinarity Metacognition Creativity

Category Data

(a) Category Data

	B	C	D	E	F	G	H
ID	Resilience	Autonomy	Cooperation	Metacogn	Transdiscipl.	Flexib.	creativity
1	0	0	1	0	0	0	0
2	0	0	1	1	0	0	0
3	1	1	1	0	0	0	0
4	0	0	1	0	1	0	0
5	0	1	1	1	1	1	1
6	1	1	1	1	1	1	0
7	0	0	0	1	0	0	1
8	1	0	0	1	0	0	1
	...	...	...	...	...	...	...
27	0	0	0	0	0	0	0
28	1	0	0	1	0	0	0
29	0	0	0	0	1	1	1
30	0	0	1	0	1	0	0

Atividade1 - Binary Data | Atividade2 - Binary Data | ... | Atividade8

(b) Binary Data

Figure 1. Collected Data: (a) Category (b) Binary - Source: the author

This research combines qualitative and quantitative approaches. Before analyzing the data, which is part of the qualitative aspect, basic statistics identified the most and least cited labels for each activity, the average of labels assigned to each activity, and the percentage of specialists that used specific labels. Additionally, it was calculated the correlation between the specialists' experience and the labeling conducted in [Oliveira et al. 2022].

After removing outliers and assuming the range of clusters as two to ten, experiments with the K-means technique determined the optimal cluster number. The Hamming distance, which measures the number of positions where label sequences differ, showed the similarity between the labels used.

[1] Aviaible in https://form.jotform.com/222554941947061

Considering the subjectivity in the qualitative aspect that involves the development of the methodology and labeling of activities, it is crucial to note that the labeling is not definitive. In the future, possessing the student evaluation of the recommended activities will contribute with additional training data, refining the labeling.

5. Results and Discussion

Through the statistical analysis and clustering of data from Figure 1(b), patterns or trends emerged from the data as well as the association of complex thinking characteristics with different Moodle activities, resulting in labeling that can be considered reliable. This section presents the phases of the data analysis. Preliminarly, the results from Google Forms data showed twenty-two (73,33 %) educators defined labeling, whose correspondence was equal to or greater than 62.5% with the initial labeling, as pictured in Table 2.

Table 2. Percentage match rate compared to initial labeling - Source: the author

% Match Rate	100%	87,50%	75%	62,50%	50%	37,50%
Num Educators	3	5	7	7	7	1

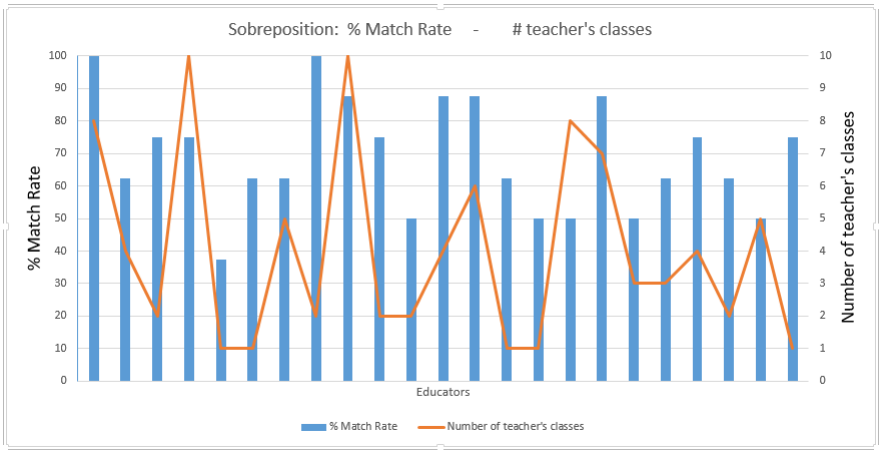


Figure 2. Teacher's Classes x % Match Rate - Source: the author

Seeking the reason for the hits as mentioned earlier, the educators were ordered by experience years with Moodle (from left to right), and the number of educator's classes (orange line) overlapped with the percentage of match rate (e.g., Figure 2 [2]). There is an oscillation (orange line) congruent to the match rate of labeling, directly proportional (in most cases) to the number of classes the teacher attended. Consequently, this made to believe that experience with large numbers of classes enhanced the understanding of labeling and the student profile. Therefore, more experienced educators could make better use of Moodle activities, resulting in improved comprehension and effectiveness in the labeling process.

Figure 3 illustrates the outliers (the "o" symbol), the range of label numbers used, varying from one to seven, with a median range between two and four labels, that are patterns achieved by analyzing the Boxplot [Khan 2021]. This information determined

[2] 7 educators provided incomplete information about the experience and the number classes

the consistency of the final number of labels used, the treatment of the outliers, and the data rearrangement. Among the thirty educators, the percentage of outliers data ranged from 6.67% (Choice) to 26.7% (Glossary), representing the lowest and highest number of outliers, respectively.

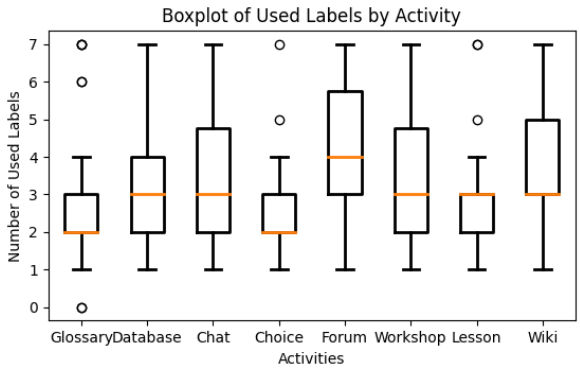
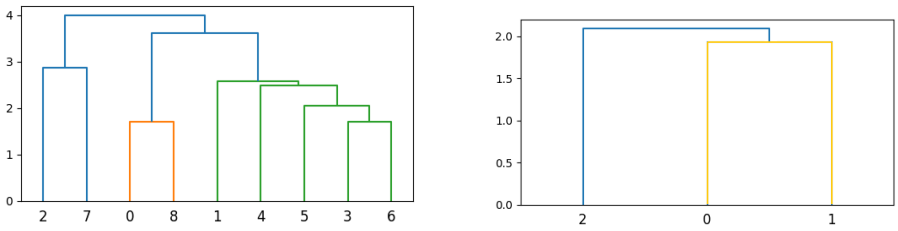


Figure 3. Boxplot: Number of used Labels - Source: the Author

Although the number of skills assigned to an activity was unconstrained, labeling them with all skills was unreasonable. Likewise, educators who did not set any labels to some of the activities were also identified (e.g., Figure 3). Results of the first round of clustering the answers (Glossary activity as sample) presented nine distinct clusters. However, there were three main groups with some similarity (blue, orange, and green) as in Dendogram (Figure 4(a)). Therefore, the execution of another round of clusterization without outliers increased the clustering accuracy as in Figure 4(b). Whortwhile mention that after data refinement, cluster 2 (Figure 4(b)) was composed by labeling from more than 50% educators, where three of these labels were the most used.



(a) First round Dendogram (b) Dendogram without Outlier

Figure 4. Dendrogram: clustering Glossary activity data - Source: the author

Refining the data by applying clustering in the Glossary activity was a motivation to identify how many skills are viable to attribute to each activity. To reach this, According to some statistics about skills used at each activity (as seen in Tabela 3 (a)), it was possible to identify the most (Dark gray) and least (Light gray) used labels. It was for the most used labels appear in the Final Labeling and those with fewer not. Another indicator expected when evaluating the Final Labeling was a correlation between the most used labels (Table 3 (b)). In the context of labeling Moodle activities, the correlation table calculated the Hamming distance between the Initial and Final labeling, which allowed for establishing the correspondence among labels assigned by the educators.

Table 3. Activities Statistics: (a) Used Labels (b) Correlated Labels - Source: the author

Activity	label						
	Resilience	Autonomy	Cooperation	Metacognition	nsdisiplinar	Flexibility	Creativity
Glossary	30,00%	43,33%	**63,33%**	46,67%	**26,67%**	33,33%	36,67%
Database	**26,67%**	**70,00%**	56,67%	53,33%	50,00%	36,67%	56,67%
Chat	46,67%	50,00%	**80,00%**	43,33%	40,00%	50,00%	**33,33%**
Choice	43,33%	**56,67%**	**16,67%**	53,33%	33,33%	26,67%	33,33%
Forum	**46,67%**	63,33%	**90,00%**	53,33%	66,67%	53,33%	50,00%
Workshop	56,67%	**70,00%**	53,33%	63,33%	**36,67%**	40,00%	50,00%
Lesson	**70,00%**	56,67%	**13,33%**	43,33%	26,67%	40,00%	33,33%
Wiki	43,33%	63,33%	**86,67%**	**30,00%**	56,67%	40,00%	66,67%

(a)

Activity	Labels with Significant Correlation		%
Glossary	Autonomy	Metacognition	44,70%
Database	Autonomy	Creativity	43,30%
Chat	Cooperation	Flexibility	43,30%
Choice	Autonomy	Metacognition	33,30%
Forum	Cooperation	Transdisciplinarity	63,30%
Workshop	Autonomy	Metacognition	53,30%
Lesson	Autonomy	Resilience	40%
Wiki	Autonomy	Cooperation	56,70%

(b)

Table 4 presents the labeling from [Oliveira et al. 2022], designated by Initial Labeling, compared to the Final Labeling. The last line shows the correspondence rate between these both labeling. Transdisciplinarity was a unique skill not used in Initial Label (emptiness on the column ”Initial”). On the other hand, the Final Labeling used all skills in at least one activity. Hence, the combination of these activities can aid the definition of student profiles as complex subjects.

Table 4. Initial Labeling x Final Labeling - Source: the author

Activities / Skills to Labeling	Glossary		Database		Chat		Choice		Forum		Workshop		Lesson		Wiki	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Resilience													**X**	**X**		
Autonomy		X		X				X	**X**	**X**		X		X		X
Cooperation	**X**	**X**	X			X			**X**	**X**	**X**	**X**				X
Metacognition		X		X			**X**	**X**							X	
Transdisciplinary						X				X						X
Flexibility					**X**	**X**			X				**X**	**X**		
Criativity	X		**X**	**X**				X			X					
Match Rate	**41,5%**		**41,5%**		**66,5%**		**66,5%**		**66,6%**		**50,0%**		**83,3%**		**0%**	

Regarding still this comparison, Wiki was the only one that did not present any common considerations. As it is not an intuitive activity, its well-successful use is not evident. In addition, the query in the Moodle database[3] for the activities used, Wiki was not listed. The most used activities by students at this institution[3] were Assignment (1988 times), Quiz (1850 times), and Forum (730 times). The last one presented high correspondence between the Initial and Final Labeling (Match Rate 66,6% as seen in table 4). Perhaps, due to its expressive use and intuitiveness.

Another three aspects supported the validation of the Final Labeling (Table 4) to bring reliability to the final result of this labeling process. First, the most cited label by every activity (Tabela 3(a)) (that one with a higher percentage) was in the Final Labeling. The opposite is also true, the labels with the lowest percentual of use did not appear in this labeling.

Second, Autonomy and Metacognition labels appear with a significant correlation for workshop activity (Table 3(b)). However, in Table 4, the Metacognition label did not appear in the Final Labeling since most of the labeling that showed this correlation were outliers. Further, the second highest correlation (33.3%) presented for this activity was

[3]Data obtained (Activities used: Froum, HVP, Game, Glossary, Journal, Quiz, Assign, and Lesson) from querying the Moodle database that those teachers use.

between Autonomy and Cooperation. As for the other activities, all those labels involved with these correlation indexes (Table 3 (b)) appeared in the Final Labeling.

Third, the percentage of correspondence between the Initial and Final labeling was calculated by assigning weights to each label. To account for the different numbers of labels in the Initial and Final labeling, the weights were equally distributed based on the number of labels in each labeling. The weight for the Initial and Final labeling, denoted by $W_{Initial}$ and W_{Final} were calculated as 100 divided by the number of labels in the Initial and Final labeling, respectively. The equivalence between the labels was determined by the sum of the equivalent labels' weights divided by two (Eq.1).

For example, the Glossary activity which was initially assigned 2 labels, setting each label occurrence to the weight of 0.5 (50%). In the Final Labeling, three labels were defined for this activity, resulting in a weight of 0.33 (33.33%) for each occurrence. Since there was compatibility between one label from the Initial and another one from the Final labeling, the equivalence between labels is determined by adding the weights of the equivalent labels and dividing by two (Eq. 1). In this case, the Glossary equivalence was 41.5% since $(0.5 + 0.33)/2 = 0.415$. Out of all the labels assigned to activities, five presented equivalence greater than 50%, while only one activity did not.

$$Eq_{label} = \frac{W_{Initial} + W_{Final}}{2} \tag{1}$$

6. Conclusions

This study presented an innovative methodology as no previous research has applied a method to labeling Moodle activities, specifically. The results indicated that the initial labeling process proposed by Oliveira (2022) can be refined, with clustering and basic statistical data playing crucial roles in improving labeling accuracy. Despite the need for further refinement, the initial labeling showed promising results that were further enhanced in the final labeling.

Several criteria were identified that can enhance the effectiveness of labeling activities, such as the number of classes attended by the teacher, the frequency of activity usage, and the teacher's experience with Moodle. Additionally, it was found that while it is reasonable for an activity to have at least one assigned skill label, using all skills as labels is not necessary. This finding significantly influenced the grouping process and improved the overall clustering and labeling outcomes.

With the positive results obtained, the next step is to proceed with implementing a recommender system based on complex thinking theory within the Moodle environment. This system will be implemented in an educational institution that already utilizes Moodle for its courses, allowing for data adaptation and comparison with validated results. To fully leverage the potential of the recommendation system and enhance the teaching-learning process, teachers will need to undergo training to better understand the activities that develop the necessary skills and emphasize their application to form a student profile aligned with complex thinking theory. This training process will contribute to the successful implementation and utilization of the recommendation system.

This work comprehensively expands the discussions of the aforementioned works, since none of them discussed several skills applied to several activities.

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