Reception: **October 9, 2024** | Acceptance: **October 3, 2025** | Publication: **February 1, 2026**

I Notice, I Wonder. Pedagogical strategy for deeply understanding and problematizing

—

Gloria Araceli García-Miranda[1]
gloriagarciamiranda810@gmail.com
ORCID: 0000-0002-0310-4185

Kátia Cilene Da Silva Moura[2]
katiacs@ufersa.edu.br
ORCID: 0000-0003-1021-0442

1 Faculty of Higher Studies Iztacala, Universidad Nacional Autónoma de México. Tlalnepantla, Estado de México, México

2 Departamento de Computação, Centro de Ciência Exatas e Naturais Universida de Federal Rural do Semiárido. Mossoró, RN, Brasil

To quote this article:
García Miranda, G. A., & Da Silva Moura, K. C. I Notice, I Wonder. Estrategia pedagógica para el desarrollo de la comprensión a profundidad y la problematización. *Espacio I+D, Innovación más Desarrollo, 15*(43). https://doi.org/10.31644/IMASD.43.2026.a01

— Abstract—

I Notice, I Wonder learning strategy was developed by The Math Forum, and it works essentially as a scaffold to promote evidence-based reasoning about a) mathematics and b) the student's mathematical thinking, although its use has extended beyond mathematics and is widely used in the United States, mainly with elementary school children to introduce them to some specific topic. This paper documents the educational experience of applying the I Notice, I Wonder strategy in environments with medical students and teachers, particularly in the Global Health curricular course. A checklist is also presented for its evaluation. Through a narrative analysis of a student's learning journal and written comments by teachers, the usefulness of the strategy is confirmed as an aid to trigger the problematizing competence; however, it requires a co-construction, basic writing skills and critical analysis from students and a willingness from medical teachers in order to get training on the strategy.

Keywords*:*

"I Notice, I Wonder"; wondering; noticing; problematize.

This paper describes an experience regarding the application and educational outcomes of the *I Notice, I Wonder strategy* (Noticing and Wondering, or "*Darse Cuenta y Preguntarse*"). The pedagogical development process began when the delivering author (García-Miranda, GA) first encountered the strategy in the MOOC *Introduction to Data Wise: A Collaborative Process to Improve Learning and Teaching* (Harvard University, USA; 2015), which was employed alongside other techniques to analyze, interpret, and reflect on a set of data, typically numerical.

Initially, the strategy was personally perceived as somewhat repetitive, as it was employed in all the thematic units of the aforementioned course. However, the reflection on the strategy enabled better appreciation of its didactic potential. Based on this experience and reflection in practice, it was decided to implement the strategy in the Global Health course with medical students at the Universidad Nacional Autónoma de México (National Autonomous University of Mexico, UNAM) and the result was encouraging, since the students reported that the exercise caught their attention and that they saw in the strategy a different way of analyzing a text. From that outcome and the experience of applying it to various student groups, it was decided to subsequently employ it in teacher training courses in medicine, and finally, an instrument was developed to evaluate the results obtained.

With the aim of establishing a reference framework regarding the use and utility of the educational strategy, a conventional search was conducted using the terms "I Notice, I Wonder", and various websites were reviewed that promote the use of the strategy and also advertise the sale of support cards to be used in primary school classrooms. Based on the content of the examined pages, it was observed that the strategy is used essentially for children to record their thoughts, to identify students' support needs, to acquire information or clarify some concepts, to learn observational skills and concentrate attention, as well as to foster creativity and the capacity of enquiry. Specifically, it was noted that the strategy is employed to assist children in developing critical thinking and problem-solving abilities in academic subjects such as mathematics and writing. Similarly, it functions to foster explicit observation and open-ended questioning.

Likewise, the I Notice, I Wonder strategy was proposed by the K20 Center for Educational and Community Renewal in Oklahoma as an educational strategy that helps students create good questions based on available information by writing what they notice and what they wonder about a new topic (K20, 2020). Furthermore, they note that the technique can be used to introduce students to a concept, issue, or idea (K20, 2022).

Conducting an advanced bibliographic search regarding the application and evaluation of the didactic strategy in research articles, it was observed that there were few studies on the didactic-pedagogical evaluation of the *I Notice, I Wonder strategy*, particularly in higher education.

It was also remarkable to discover that the strategy was developed by The Math Forum for teaching mathematics and that its application has currently extended to other areas of teaching and educational levels. In Garret and Matranga (2020) the I Notice, I Wonder strategy in mathematics instruction function as a scaffold to develop evidence-based reasoning about mathematics itself and students' mathematical thinking.

Garret and Matranga (2020), based on a conceptual analysis that contrasts traditional teaching centered on information and skills (narrow paradigm) versus an expanded paradigm focused on Access to Discourse and Practices (ADP), present the educational experience of implementing *Noticing and Wondering*. The authors regard the novelty of their contribution lies in the context of K-12 education in United States and share insights derived from the systematic, long-term use of these two pedagogical phrases that encourage thinking and discourse. The authors conceptualize *Noticing and Wondering* as a reference point for instructional approaches that focus on the use of this set of phrases on a consistent basis.

Noticing and Wondering is asserted to be an innovative pedagogical strategy with documented effectiveness in mathematics education, while representing potential for other fields of study in embracing a *paradigm of discourse and learning practices* and thus may prove generalized beyond K-12 classrooms. The authors additionally argue that it shows promise for multilingual students. They view *Noticing and Wondering* as a *culturally and linguistically sensitive* tool that can enable teachers to effectively address all students' competencies and needs. It is posited that *Noticing and Wondering* has the potential to create a democratic learning environment where all students have opportunities to participate and learn, even when students may feel less capable than their classmates. The accessibility of *Noticing and Wondering* directly guides teachers and students toward ensuring equitable access for all learners to sophisticated reasoning and language use.

According to Garret and Matranga (*op. cit.*), *Noticing and Wondering* by its very nature, creates a conduit for cultural relevance in the classroom and acknowledgment of students' prior and existing knowledge, as *Noticing and Wondering* constitute expressions of what learners deem personally and culturally meaningful. When teachers invite students to notice and wonder, students' culture and familial discourses are granted a space in the classroom community. Even before the teacher recognizes student input, the act of asking students to articulate what they already know or think about a topic serves as a powerful catalyst for thinking, which is significant for developing student engagement.

On the other hand, Plutino (2021) points out that motivation to learn begins with wonder and that questioning goes beyond curiosity, which the author defines as the drive to explain the unexpected (citing Piaget, 1969) and the drive to know more (citing Engel, 2011). When students wonder, they articulate their desire to know both what they do not know and what they already know. The author notes that *I Notice, I Wonder*, has been effectively employed in elementary education

across various subject areas, primarily in science, technology, engineering, and mathematics. However, her work demonstrates how this instructional strategy may also provide an opportunity in modern foreign language instruction, largely due to the educational challenge that students find it increasingly difficult to develop curiosity about these languages. The author proposes implementing extension activities (such as the creation of a Day of the Dead ofrenda for Spanish language learning) and their integration with "Wonder Pedagogy", noting that when this strategy is employed, both interest and learning are enhanced, as learners become agents of their own learning by generating their own set of questions. The author asserts that the strategy represents an activity that goes beyond the stereotypical image of language learning, instead allowing students to "think outside the box" while establishing connections with other subjects and approaches. Plutino (*op. cit.*) proposes reinforcing such activities at different educational levels and creating inter-institutional networks between schools and universities to foster mutual inspiration and thereby address the limitations of an overly rigid, assessment-focused language curriculum.

Furthermore, Anderson and Dobie's (2022) work investigate how the use of sentence stems, "I Notice" and "I Wonder", operates to promote productive dialogue in asynchronous sessions of an online course for kindergarten through second grade (K-2) teachers. Drawing from teachers' responses to peer reflections in the classroom, the study sought evidence concerning how course prompts encouraging teachers to employ these stems influence the nature of contributions they provide. The authors regard the practice of prompting teachers to share what they "Notice" and "Wonder" about classroom activity representations as a promising direction for future research and practice related to teacher perception in online and offline settings. Similarly, they believe the results offer encouraging evidence that "I Notice" and "I Wonder" can create learning opportunities in which teachers, by engaging with one another's responses, gain exposure to greater variation in perspectives and ideas, thereby generating meaningful impacts on teacher learning and discourse.

The mechanisms for evaluating the results of the *I Notice, I Wonder strategy* have also been different. In Lowe's work, Prout and Murcia (2013) used a reflective journal as part of a teacher exchange experience. Five selected teachers from Western Australia participated in a mentoring project with teachers in Tanzania. Australian teachers spent a month embedded in local primary and secondary schools, working collaboratively with their Tanzanian counterparts. As a strategy to make sense of their experiences, each teacher was asked to keep a reflective journal, using *Harvard's visible thinking routine of "see, think, question*" as a critical structure to guide their journal writing. The primary objective of the research was to examine the effectiveness of the reflective journal as a tool enabling teachers to construct meaning from their teaching practice, particularly in challenging or conflictual instructional situations, and to evaluate the usefulness of the Harvard approach in structuring the reflective process as a component of an action-based model.

Additionally, Watson (2002) describes the application of the strategy in a teacher training process with professionals and practitioners. To evaluate the impact of the exercise, teachers kept journals in which they recorded their reflection-in-practice and thoughts generated through *I Notice, I Wonder*. The narrative analysis of both the journals as a corpus and individual participant narratives led the author to develop his own reflective insights concerning what he noticed in the participants' narratives.

For instance, particular pedagogical trends and concerns: one teacher genuinely questioned how to connect with children, how to establish relationships with them (whether she had been relevant, empathetic, or confusing, whether she succeeded in understanding young people's humor and vice versa). The analysis and feedback regarding participants' journals prompted the author to utilize the twin tools of "Noticing" and "Wondering" in reflecting upon both his own teaching practice and that of his students (pre-service teachers).

Anderson and Dobie (*op. cit.*), in turn, adopted a *discourse analysis* approach in an online course, constructing categories based on discussion forums among teachers, since teachers were prompted to respond to their peers' reflective posts in various course segments.

To make even more evident the spectrum of potential of *I Notice, I Wonder* one can cite the work of Dobie and Anderson (2021), in which the authors present a detailed analysis and guide concerning how noticing and wondering can help structure important school-based conversations. Examples include student thinking, power and participation, and task cognitive demand. Furthermore, they suggest specific contexts in which "I notice" and "I wonder" can be used in both face-to-face and virtual environments.

Therefore, evidence exists that the "Noticing" and "Wondering" exercise holds potential for application across various educational contexts and levels, though scientific evidence remains scarce, especially in higher education. Concerning this matter, Garret and Matranga (2020) conclude that the *I Notice, I Wonder strategy* could be broadly applied in science and that considerable benefit would accrue from conducting an empirical study of its impact. Anderson and Dobie (2022), in turn, assert that while recent publications addressing the utility of *I Notice, I Wonder* have begun to be published, the empirical research base linking "I notice" and "I wonder" to teachers' learning processes remains limited. The authors, based on the proposals of Fukawa-Conelly et al. (2018) and Roller (2019), agree that previous studies have suggested that encouraging teachers to "Notice" and "Wonder" can influence the content and form of their participation in instructional conversations, though the depth and systematicity of these associations are unclear. They further assert that, despite the apparent self-explanatory nature of the 'I notice' and 'I wonder' stems, it remains unknown how frequently teachers take up these phrases, how they are actually employed, and how such use might relate to common challenges in fostering dialogue in teacher professional development environments.

RESEARCH PROBLEM

Over the course of our teaching experience in medicine, we have become aware that when students are questioned regarding a topic, problem, or situation, the response is typically an opinion or anecdote, regardless of whether the exercise requires analyzing, synthesizing, arguing, or another form of discourse. Additionally, in a situation also encouraged by the curriculum itself, they propose research questions without problematization, either disconnected from theory or merely imitating previous research. The situation has been further complicated by the fact that students face increased challenges in articulating their thoughts and presenting publicly in the post-pandemic era. Additionally, when analyzing cases requiring a holistic problem perspective, their contributions demonstrate a reductionist outlook and are treated from a clinical logic. This context encouraged us to apply the *I Notice, I Wonder strategy* as a means to inevitably establish a reference point for questioning and to facilitate the problematization, organization, and socialization of thoughts.

The present study reports empirical evidence on the implementation of the *I Notice, I Wonder strategy* and a *custom-designed* assessment instrument. The strategy's potential and educational achievements are discussed, and pedagogical reflections are shared concerning the approach applied in medical education with students from different sections of the "Global Health" course at the Faculty of Higher Studies Iztacala, UNAM, in addition to a teacher training group at UNAM and another at the Federal Rural University of the Semi-Arid Region (Universidade Federal do Semi-Árido, UFERSA), Brazil.

Objetive

To describe the experience of implementing and evaluating the *I Notice, I Wonder strategy* and its pedagogical potential in medical training settings, specifically with Global Health course students and medical faculty.

Methodology

Participants

The *I Notice, I Wonder* strategy has been employed in the "Global Health" course at the Faculty of Higher Studies Iztacala, UNAM (Mexico); in a teacher training course within UNAM; and, recently, at the Universidade Federal Rural do Semi-Árido (UFERSA), in the faculty training course *Estratégias de Ensino-aprendizagem Innovadoras* (Innovative Teaching-Learning Strategies) (UFERSA: 2022), which developed a set of innovative strategies designed to foster problematization skills, decision-making, and the development of alternative models for representing knowledge and social realities.

Method

Qualitative research. Longitudinal participant observation in eight Global Health courses for medical students and two teacher education courses. Construction of an evaluation checklist for student exercises, which was the piloted through peer assessment activities among students, as represented in Figure 1, in order to identify the instrument's performance, potential difficulties or gaps, and students' overall perceptions. Following the pilot phase, the evaluation instrument was refined. Content analysis of learning journals from 'Global Health' course students.

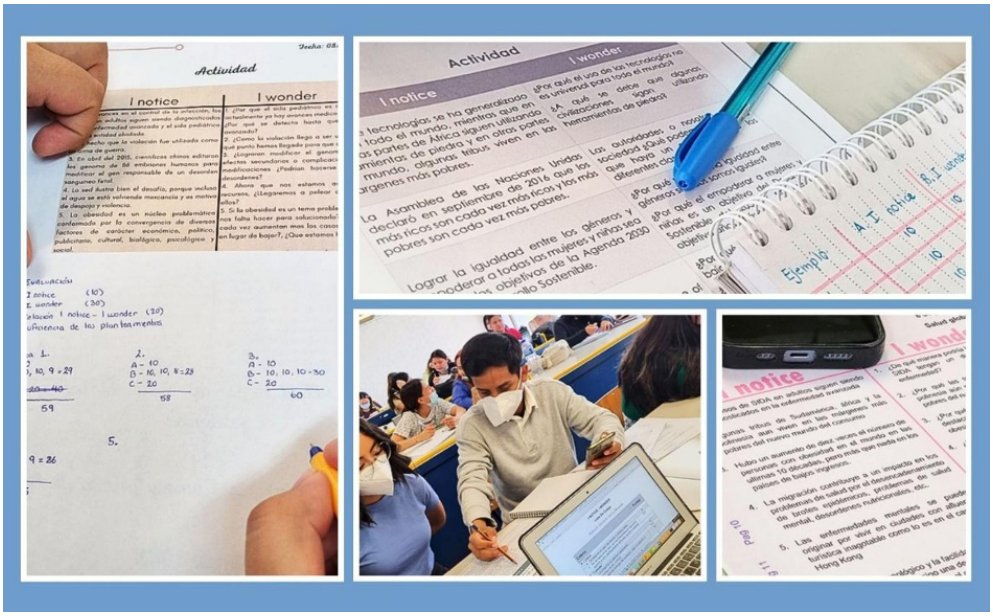

Figure 1. Co-evaluation exercise by the students, carried out with the idea of doing a pilot test of the checklist

Instruction for strategy development

In the K20 version, students document observations and questions regarding a topic that has been introduced to them only briefly. Subsequently, they share selected items with their peers, and a collective class list is generated that remains accessible throughout the duration of the activity. Upon task completion, students revisit both their own questions and those they initially sought to have answered, verifying that all have been addressed (K20, 2020). This instruction varies from those reviewed in the theoretical foundations. For instance, Anderson and Dobie (2022) provided the following instructions to encourage asynchronous dialogue among teachers in an online teacher education course: "Choose at least two colleagues" reflections to comment on. For each of the two reflections, try using the prompts "I notice..." and 'I wonder...'. An additional prompt was "Read at least the reflections of two other colleagues. Share a new idea or question that arises

after reading the aforementioned reflections. If they have formulated a question or identified a challenge, support them in developing possible ideas".

In our practice, students were asked to read an article on global health foundations (García-Miranda: 2019) and then, based on the aspects of the article that most surprised them from the reading, to use the *I Notice, I Wonder* phrases to highlight the events that surprised them and the questions generated by the reading. We implemented this strategy in the "Global Health" course as a formative evaluation tool to assess students' level of understanding or engagement with the reading, as students commonly address text analysis assignments by reading the document, marking what they consider most important, but at the moment of conducting the analysis in groups or in writing, they typically only paraphrase what they have read.

This strategy could additionally be implemented as part of a shared reading activity using a brief text to facilitate discussion of a problematic topic or situation, and to provide a preliminary overview of topic content. When a topic has been previously examined, the visual component can assist in synthesizing the subject matter, problematizing the situation, and uncovering the importance of the reviewed material. Table 1 outlines suggested didactic resources that can be utilized in accordance with particular learning objectives.

Table 1

Resources for the development of the I Notice, I Wonder strategy according to the learning purpose

Purpose	Didactic resource
Introduce students with a concept, topic or idea.	Short note from a newspaper, video or eye-catching image.
Formative assessment of the comprehension of a text.	Article or text of regular length.
To determine topics of interest for students.	Short or regular length text.
Problematizing an event or reality.	Report of an event, image with brief descriptive text, a case in different formats.

For recording proposals, participants were asked to develop a "T- chart or table with "I Notice" labeling the left column and "I Wonder" labeling the right column. In Spanish, the phrases "Me doy cuenta, Me pregunto" were utilized, and in Portuguese: "Eu percebo, Eu me pergunto". The exercise can be conducted individually, followed by group sharing to analyze collectively which questions need correction or precision, as shown in Figure 2.

The strategy can also follow an alternative route whereby one question is selected from the collected set for further investigation. Additionally, questions can be analyzed collectively to identify central problematic themes, especially when studying real-world phenomena.

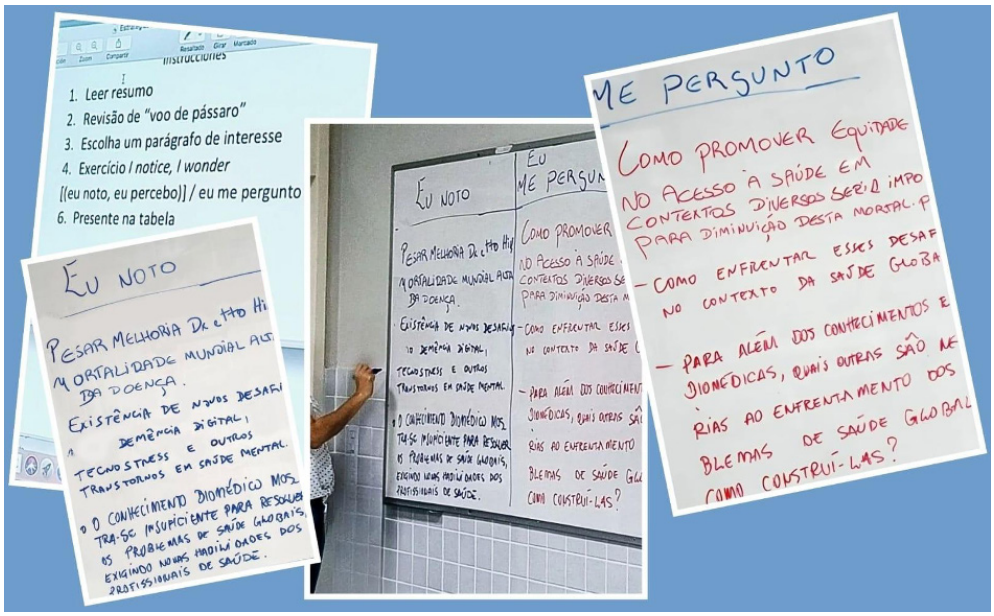

Figure 2. Demonstrative exercise conducted by teachers applying the basic instructions of the learning strategy

Evaluation of the strategy's usefulness

Students enrolled in the "Global Health" course were requested to maintain a learning journal (with previous guide) for all course sessions, among which were those employing the "I Notice, I Wonder" sentence stems. Content analysis of the journals was conducted to evaluate the meanings of learning outcomes and identified benefits. Teachers, for their part, were asked to provide comments on the educational value they attributed to the strategy.

Results

Given that we have principally utilized the *I Notice, I Wonder strategy* in "Global Health" courses and teacher education courses, though with readings on the same theme, the examples are focused on that subject. Table 2 shows several examples developed by participants and discusses their appropriateness.

Table 2

Analysis of some I Notice, I Wonder approaches made by the participants

I Notice	I Wonder	Comment
The article mentions how children residing in areas with armed conflicts cannot distinguish between a weapon and a camera.	Why, despite the fact that this problem has existed for several decades, has it not been possible to take action regarding children in refugee camps?	In the *I Notice* statement, the student constructed a generalization based on an individual case. Nevertheless, the question is not wholly specific, inclined to be obvious and to constitute a generalization supported by minimal argumentative foundation.
The article emphasizes that global health is linked to numerous aspects, including political, economic, social, and cultural factors.	Is there any international law that provides legislative and judicial regulation of human rights violations?	*I Notice* refers to the content of the article read; in this sense it constitutes a pertinent observation. The question is specific and original.
Emotional and mental health is a subtopic addressed in the article, in which most developed Eastern countries face these types of problems. In my view, and drawing upon information I had previously read, many of these reasons for this pressure originate from culture and society themselves.	Why is mental and psychological health consistently relegated to last place? What are the appropriate measures being taken by the WHO concerning these issues? Do religious considerations in certain countries constitute an impediment to discussing specific mental and psychological health topics, politics or religion?	This example demonstrates that the participant integrated observations from the article with prior knowledge and generated several questions, indicating the construction of "scaffolding" to create or strengthen new or existing cognitive structures. Here, the value of problematization is substantial, as the participant not only formulated a question but developed a problem nucleus.
Currently, scientists have the means and ability to combine genetic species of animals such as zebra-horse, lion-tiger, goat-sheep. Plant species can also be combined fulfilling the whims of the human being, all this is not compared to the greatest desire that is to be able to alter and modify the human organism.	A benefit for humanity or scientific greed? In my opinion, it represents a combination of both, given that it could be utilized to address food crises in vulnerable areas. However, it is uncertain whether scientific communities have been financially supported to conduct this research.	In this task, students make precise observations and ask questions that inform an opinion. Clearly, the question arises from their engagement with the observation.
Although I already knew about other genocides throughout history, I was not deeply familiar with their cultural context.	Were these genocides really visible enough so that they do not happen again?	The observation is related to the text read, though it does not constitute a specific observation. The question is pertinent and reflects critical analysis.
Addiction to diverse electronic media affecting our health. The article addresses technology addiction, noting the emergence of the so-called "technostress".	Is technological innovation being used in our favor or against us?	The observation is related to the text read, though it does not constitute a specific observation.

Utility

In summary, the overall results of the implementation of the strategy show the following advantages:

- It helps students think critically and avoid making baseless comments.
- It supports the formulation of relevant questions.
- It enables dialogue with prior knowledge and encourages reflection on one's own learning.
- It allows students to explore new knowledge and experiences.
- It contributes to the consolidation of prior or recent learning.
- In terms of formative assessment, reading students' responses allows for conceptual corrections and improvement in the written expression of observations and questions.
- It increases intrinsic motivation to learn by awakening the desire to know more and continue exploring the topic or question. This also encourages student commitment to the task.
- The exercise of becoming aware and formulating questions based on an observational experience generates feelings of doubt, curiosity, and wonder. The world yet to be known expands.
- Combat the dogmatism of reading and rereading for memorization purposes.
- It generates new ideas.

In particular, group discussion after individual work offers the possibility of: a) improving awareness of one's own thoughts and recognizing one's capacity for self-criticism; b) foster appreciation among participants for the diversity of opinion that invariably arises when viewpoints are shared openly and honestly; and c) acting as catalyst for diverse ideas.

In general, professors show less receptiveness to the technique (explained in disadvantages). Nevertheless, there are also instances of professors who are highly interested and willing to participate in innovative strategies. They discover the value of the strategy, as seen in the following excerpts from learning journals of students in the "Global Health" course:

> *"A metodologia do "I notice, I wonder" [...] são ferramentas interessantes para tornar o processo de ensino-aprendizagem menos maçante. Me senti mais confortável no uso da ferramenta "I notice, I wonder", tendo em vista que ela me pareceu mais fácil de ser aplicada no contexto do Eixo Teórico-prático Integrado (ETPI), onde estou inserido como docente. "I notice, I wonder" pode ser utilizada para dinamizar temáticas que os(as) discentes tenham realizado a leitura prévia do assunto por meio de material disponibilizado pelo(a) docente".*

"A metodologia "I notice, I wonder" e [...] foram o primeiro contato que tive a oportunidade de ter. Apesar de ser tutora de Problem-based learning e estar inserida como docente em um curso cujas as metodologias ativas são o cerne da aprendizagem, a estranheza inicial, talvez pelo idioma da leitura inicial, tomou-me de surpresa, porém em poucos instantes com as intervenções e direcionamentos da Prof. Glória pude contemplar e pensar nas utilidades dos dois novos métodos a mim apresentados".

"A metodologia "I notice, I wonder", permitiu-me de forma dinâmica identificar pontos chaves do artigo em questão, ao passo que simultaneamente me estimulou a pensar criticamente com a necessidade de fazer uma pergunta a cada observação escrita. Tal ferramenta pode ser de grande valia para leitura de artigos e discussão em grupos maiores de alunos, proporcionando direcionamento aos pontos principais da leitura bem como proporcionar o desenvolvimento de pensamento crítico ao provocar questões/perguntas sobre tais pontos, que possivelmente poderão fomentar um leque de possibilidades de resolução de problemas".

"I notice, I wonder" consiste em identificar pontos extraídos de texto e então problematizá-los através de uma pergunta chave. Com o emprego do método acredito que existirá uma leitura mais consciente além do desenvolvimento de senso crítico pelo grupo".

Disadvantages

Participating students have been observed to experience difficulties in establishing the limits of observation and in overcoming the inclination to provide opinions rather than to problematize. An additional dimension of this limitation in problematization stems from students is the habitual practice of generating summaries as the product or evidence of comprehension when reading documents for assignments. Nonetheless, *I Notice, I Wonder* requires critical judgement for choosing relevant information from the reading and developing questions based upon it. Another limiting factor is the resistance, friction, or tension associated with embracing critical reading instead of uncritical reading founded on repetition and memory. Despite these challenges, the student body is usually willing to carry out the exercise.

Overall, in the case of teachers, their approaches are usually brief and present the same difficulties as with students, although there is also resistance to changing the role of teacher and working openly on the assignment. Most teachers exhibit discomfort at the beginning of the exercise and some of them argue that they are "not accustomed to it". Adopting the student's role proves difficult for them. Teachers identify the usefulness of the technique to apply it with students, but not to develop it personally.

The strategy encourages divergent thinking, which could pose challenges for teachers to guide the process in terms of articulating students' questions and comments in relation to a particular topic while maintaining the limits of the activity's themes and objectives.

In the specific context of the Global Health course, *I Notice, I Wonder* serves as an effective resource for exploring the importance and challenges of global health. Like any learning strategy, it should not be used repeatedly, as this leads to participant saturation and subsequent decline in motivation.

Generally, the strategy's potential is lower with extended texts, whereas it demonstrates substantial benefits when applied to images, videos, short texts, or real-world cases.

Activity assessment

If the objective is to review the statements produced by participants and assign a grade, the following checklist is proposed, as shown in Table 3.

Table 3

Checklist. Constructed to assess five statements (I Notice) and their corresponding questions (I Wonder)

Criterio	Total score	Score achieved (per exercise and total)				
A. *I notice*						
	Exercise:	1	2	3	4	5
• It is based on the given case study or reading.	5					
• It is not based on the case, it is a personal interpretation, opinion or other approach derived from another context.	1-4					
• The writing is forceful, clear, and precise.	5					
• The writing shows ambiguities or inaccuracies.	1-4					
Subtotal						
B. *I wonder*						
	Exercise:	1	2	3	4	5
• The question is clearly stated.	10					
• The question is unclear/confusing.	5-8					
• Question emerges from the context, case study or reading.	10					
• Question does not stem from observation of the context or case study.	5					
• Questions reveal deep analysis or are formulated as problematic cores (question sets addressing a single problem).	5-10					
• Questions demonstrate simplistic construction, forced formulation, or obvious answers.	1-5					
Subtotal						
C. The relation between *I notice* and *I wonder*						
	Exercise:	1	2	3	4	5
• They demonstrate mutual coherence.	20					
• No correspondence exists between observation and question.	5					

	Subtotal					
D. Sufficiency of the approaches						
	Exercise:	1	2	3	4	5
• A minimum of five In-Iw approaches were carried out.	20					
• Fewer than three statements were produced.	5-19					
• The entire reading or context was taken into consideration.	20					
• Statements were constructed using only a portion of the reading or context under study.	5-19					
Total score	**100**					
Comments:						

Evaluation of the strategy by students

Four primary categories concerning the educational value of the technique are identified in the metacognitive reflections expressed within student learning journals: the importance and perception of the activity, "dialoguing with the author" (dialogue exercise), advantages of engaging with "I Notice" and "I Wonder" and alternatives for overcoming rigid reading. Illustrative testimonies from participants are presented below:

> "Today we conducted the group review of the co-evaluations of the 'I notice, I wonder' activity, and I realized how interesting this activity was for me. I learned to be more specific and clearer with my ideas when formulating statements and questions, while simultaneously understanding the importance of establishing coherence between these elements within the work. [...] Regarding the article, I realized that we need to carefully select the ideas we take from it to better understand the reading".

> "The exercise serves as a form of dialogue with the author of the article, where we can pose new questions that encourage further research, by identifying key points that are complemented and integrating them with knowledge we already had from previous readings, the analysis becomes even more complete".

> "The reading becomes more condensed and easier to comprehend, since the technique itself makes it simpler for the reader"

> "In this activity I learned to reflect more deeply on my reading, to move away from such rigid reading and adopt a more reflective reading, since information is often forgotten when it doesn't pass through that mental filter. Furthermore, all information

leaves us with something newly learned, and we will only recognize this when we engage in philosophical and argumentative thinking about the topic".

"This was truly an exercise that facilitated the reinforcement of knowledge gained from the article and improved our writing and question-generation abilities. I personally valued the activity because it facilitated the reinforcement of knit, which permitted me to perceive the article from another perspective, as the statements and questions of the classmate assigned to me for evaluation diverged from my own, allowing me to become aware of aspects I had initially overlooked".

"During the "I notice, I wonder" activity, I pondered whether implementing a public policy to restrict electronic device use would be advantageous [...], since health issues resulting from excessive electronic device usage affecting multiple organ systems have emerged recently. However, it's important to consider that new technology also provides benefits. This leads me to conclude that the activity represents an outstanding reflective exercise that not only enhances our understanding of the reading but also encourages us to examine the relevance of the information and even relate it to our personal perspectives".

DISCUSSION AND CONCLUSIONS

Confronting a different way of addressing problems and learning is probably the most significant obstacle to engaging with the *I Notice, I Wonder* strategy; this difficulty is observed not only in students but also in teachers. In this regard, we concur with Watson's (2002, p. 117-120) work, who concludes by stating the following:

> I realized that others often struggle to notice. Students enter school far too frequently, holding the belief that "correct answers" exist and that possibilities for responding to coursework are limited. They show resistance to use the first-person perspective in essays, [...] and lack trust in their reactions to practical experiences [...].

Through this work, we have identified a certain intellectual conditioning with respect to how problems are conceptualized, and new knowledge is acquired, notably, we have observed that in medical education, despite the introduction of new pedagogical frameworks, a positivist orientation toward content persists and, as we previously noted, problem-solving approaches are characteristically formulated, in first approximation from clinical logic: *causation, diagnosis,* and *therapeutic intervention.*

Aligning with this challenge, Witt, Onorato, and Schwartzstein (2022) have observed the particular tendency in medical students to increasingly request a "response key" for all aspects of their education. Students routinely anticipate having correct answers immediately available to ensure their conclusions are accurate and to determine precisely what knowledge they need to master. Although much

of medical practice, particularly in the care of critically ill patients with multisystemic diseases in intensive care units, the answers are uncertain and the body of knowledge is growing more and more. Student's demands for single solutions pose a threat to their development as self-reliant, critical-thinking physicians. In line with our observations, the trend identified by Witt, Onorato, and Schwartzstein (2022) may find part of its origin in the imperious hierarchy ascribed to grades and examinations throughout the different stages of their formation.

Given the above issues, it is necessary to develop strategies that promote critical judgment. Similarly, problematization stands as a fundamental intellectual exercise not only for global health, but for all sciences and disciplines. Since questions are starting point of research, the *I Notice, I Wonder* strategy could be utilized in various educational settings.

Regarding the nature of questions, it is important for the professor to identify their complexity, since this allows us to gain insight into student's thinking, their academic and personal concerns, and the cognitive skills they put into play. At least three types of questions could be considered: *Confirmative* (to refine understanding), *Clarifying* (to resolve uncertainty), and *Challenging* (to address problematic situations). Nonetheless, "we have observed" during initial *I Notice, I Wonder* practice that questions often formulated by paraphrasing what has been noticed, becoming questions when "why" or "how could one..." is appended. This implies initial questions are characteristically grounded in superficial or limited observation and may contain implicit value judgments. The quality and depth of questions, however, improve in later exercises, with increasing prevalence of those advancing provocative ideas or presenting intellectual challenges (termed *challenging questions* earlier).

On a different but equally important point regarding question-posing. Wolbert and Schinkel (2020) argue that questioning serves educational significance beyond motivating learning, it is fundamentally important because it represents an integral aspect of learning to comprehend the difference between "what you don't know, what you merely believe you know, and what you (as human being) cannot know or understand". We might further observe that analysis of student-posed questions could facilitate teachers' identification of students' learning needs.

At the operational level, in order to obtain greater educational benefits from the *I Notice, I Wonder* strategy, it is necessary to practice the process several times, review the approaches and feedback the work of the participants.

It is also essential that teachers incrementally develop their ability to comprehend and interpret the thinking of activity participants. The *I Notice, I Wonder* strategy facilitates, in some measure, the tangible expression of students' thought processes, something absent in traditional instruction when teachers ask did you understand? and students simply remain silent, respond with a mere "yes" or choose to "analyze" situations through personal opinions or anecdotes.

Finally, designing and adapting approaches for varied learning contexts requires co-construction that teachers engage in the same or similar learning experiences themselves. It also demands reflective practice grounded in student learning outcomes and one's own metacognitive processes. In essence, innovation in the classroom extends beyond merely applying techniques, an *instrumental understanding of teaching*, to encompass the development of genuine pedagogical thought.

This study presents practical classroom experience, describing an initiative that indisputably contributes to the improvement of the student learning process in "Global Health" courses and, although with some caveats, in the pedagogical training of medical faculty.

We consider the *I Notice, I Wonder* experience presented here innovative based on the three factors: a) It originates from Anglo-Saxon educational traditions, with no prior Spanish or Portuguese scholarship identified; b) Unlike reviwed studies, its application targets advanced cognitive outcomes, specially the development of problematization skills, fundamental to scientific training; c) It introduces an original evaluation checklist for assessing the appropriateness of observations (*Noticing*) and a framework for analyzing the nature and complexity of questions generated (*Wondering*).[1]

1 **Acknowledgments**

To Diana Benítez Escamilla for her support in editing the images.

To the professors at the Universidade Federal Rural do Semiárido for their kind participation. To all the students for sharing their learning journals and the commitment to the task, which pleasantly surprised us and allowed us to structure the methodological proposal presented in this paper.

REFERENCES

Anderson E. R. y Dobie T. E. (2022). Sentence Stems to Foster Dialogue: Uses of "I notice" and "I Wonder" in Outline Teacher Professional Development. *Journal of Teacher Education, 73*(1), 1-14. https://journals.sagepub.com/doi/10.1177/00224871221087198

Dobie, T.E. y Anderson, E.R. (2021). Noticing and wondering to guide professional conversations. *Mathematics Teacher: Learning and Teaching PK-12*, 114, 94-102. https://doi.org/10.5951/MTLT.2020.0210

García-Miranda GA. (2019). Retos Para la Cooperación en Salud Global desde un enfoque histórico, sistémico y emergente. *Revista científica de UCES. 24*(1),1-24 https://publicacionescientificas.uces.edu.ar/index.php/cientifica/article/view/640

Garret D. M. y Matranga A. (2020). Culturally and Linguistically Responsive Noticing and Wondering: an Equity-Inducing yet Accesible Teaching Practice. *Journal of Multicultural Affairs, 5*(1), Article 5. https://scholarworks.sfasu.edu/jma/vol5/iss1/5

K20 Center, 2020. I notice, I wonder. https://learn.k20center.ou.edu/strategy/180.

K20 Learn. (s.f.). I notice, I wonder-Learn strategy. [Video]. YouTube. https://www.youtube.com/watch?v=gPtelrwiVjM.

Lowe G.M., Prout P., y Murcia K. (2013). I See, I Think, I Wonder: An Evaluation of Journaling a Critical Reflective Practice Tool for Aiding Teachers in Challenging or Confronting Context, *Australian Journal of Teacher Education, 38*(6), 1-16. https://doi.org/10.14221/ajte.2013v38n6.6

Pluttino, A. (2021). Learning through wonder. Imprinting wonder in language learning for lifelong engagement. En Beaven T. y Rosell-Aguilar F. (Eds.), *Innovative Language Pedagogy Report* (pp. 35-41). Research-publishing.net. https://doi.org/10.14705/rpnet.2021.50.1233

UFERSA. (2022, septiembre 19). *Promove formação em estratégias de ensino inovadoras para docentes do Curso de Medicina.* https://assecom.ufersa.edu.br/2022/09/19/ufersa-promove-formacao-em-estrategias-de-ensino-inovadoras-para-docentes-do-curso-de-medicina/

Watson, J. S. (2002). Teaching ourselves to notice and wonder. En *Herstmonceux IV. The Fourth International Conference on Self-Study of Teacher Education Practices. Making a Difference in Teacher Education Through Self-Study*. Herstmonceux Castle, East Sussex, England (pp.117-120.) https://www.yumpu.com/en/document/read/32777681/making-a-difference-in-teacher-education-through-self-study-

Witt E.E., Onorato S.E., y Schwartzstein R.M. (2021). Medical Students and the Drive for a Single Right Answer. *ATS Scholar, 3*(1), 27–37. https://www.atsjournals.org/doi/10.34197/ats-scholar.2021-0083PS

Wolbert L. y Schinkel A. (2020). What should schools do to promote wonder? *Oxford Review of Education, 47*(4), 439-454.