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"The world is no longer flat to me": student perceptions of threshold concepts in world regional geography

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Through qualitative analysis of 80 student essays, the author examines geographic concepts students describe as holding traits of threshold concepts. With a group of 11 Honors students, the author employs metacogntion, asking students to analyze their own learning to discover their threshold concepts. Recognizing the role of liminality, this study suggests combining metacognition and geographic concepts to enable students to recognize their preconceptions, build or reconstruct their schemata and transform their understanding of a discipline.

Keywords: Threshold concepts; metacognition; world regional geography

Introduction

"I just saw a commercial about Sandals resorts, and I couldn't help but think about the commodification of exotic lands! Just wanted you to know . . ." (Terra Burley, pers. comm. 2011).

The message I received from a student who took my world regional geography class, more than a year after the class, warmed the heart of this geographer. Messages like these fuel professors who enjoy teaching undergraduate students. A 21-year-old student, an art major, was watching television and thinking like a geographer.

How do students like this one find their way to thinking like a geographer, to applying geographic concepts including commodification of place? Why do other students who took the exact same, one semester world regional geography class never quite get to the point of thinking like a geographer? To think like a geographer, a student must understand and apply geographic concepts. Each discipline has a set of concepts that enable practitioners to categorize experiences according to a set of criteria or attributes (Martorella, 1972). Thinking geographically or thinking spatially "requires knowing, understanding, and remembering spatial information and concepts" (Jo & Bednarz, 2011, p. 70).

Since the 1950s, educators have studied how students learn concepts. Jean Piaget's learning cycle theory has been one of the most influential. Following learning cycle theory, educators teach students concepts by exploring a concept, introducing a concept and then applying the concept (Szabo, Atkinson, & Spooner, 1985). When students develop an understanding of concepts, they are able to more easily process new information because they are able to "see patterns, relationships, or discrepancies" (Bransford, Brown, & Cocking, 2000, p. 17). Through a conceptual framework in a discipline, a student can "apply what was learned in new situations" and "learn related information more quickly" (Bransford et al., 2000, p. 17).

Students structure their prior knowledge or understanding of a discipline or problem in their schemata, systems of organization or scaffolds of information learners carry in their

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minds. Concept learning takes place when students restructure their schemata. "If a student is to gain understanding of a concept, the student must apply and personalize that concept so that it enters his/her schemata and becomes meaningful . . . ." (Fouberg, 2000, p. 198).

The constructivist theory in education builds on Piaget's learning cycle and understanding of schemata, but contends that students must create meaning for concepts through authentic assignments and personalize concepts in order to gain deep understanding (Blumenfeld, 1992). Instead of teaching students to memorize definitions of concepts, often with flashcards, constructivists recognize "one does not understand a concept adequately until it becomes clear how it is used and how it relates to other concepts" (Stanley & Mathews, 1985, p. 70).

Research in concept learning has also questioned how students get to the point of deep understanding so that students can apply a concept, such as commodification of place, years after learning it. Meyer and Land (2003) contend that learners can cross a threshold from a primitive or rote understanding to a deep and integrated understanding. Threshold concepts pave the way across the portal. Threshold concepts are breakthrough concepts, which once learned, open the door to understanding in a discipline, in this case to thinking like a geographer.

Through qualitative analysis of 80 student essays, the author examines geographic concepts students describe as holding traits of threshold concepts. With a group of 11 Honors students, the author employs metacogntion, asking students to analyze their own learning to discover their threshold concepts. Recognizing the role of liminality, this study suggests combining metacognition and geographic concepts enables students to recognize their preconceptions, build or reconstruct their schemata and transform their understanding of a discipline.

What makes a concept a threshold concept?

In the early 2000s, a group of educators across disciplines in the UK worked to define "possible characteristics of strong teaching and learning environments" in undergraduate education (Cousin, 2006, p. 4). Through the national research project Enhancing Teaching-Learning Environments in Undergraduate Courses, Meyer and Land, two economists, developed the idea of threshold concepts.

Threshold concepts are transformative, irreversible, integrating, bounded and can be counter-intuitive (Meyer & Land, 2003, 2006). Threshold concepts are transformative because they shift the perceptions of learners. They are irreversible because threshold concepts help students see the world in a new way. Once a student learns a threshold concept, he or she will be unable to return to a more primitive way of understanding. Threshold concepts are integrative because they expose the interrelatedness of multiple concepts. They are often counter-intuitive because threshold concepts do not follow a common sense, intuitive or preconceived understanding. Finally, they are bounded in that they differentiate conceptual understandings of the world (Meyer & Land, 2003, 2006).

Threshold concepts take research in geography education beyond learning concepts to uncovering how students learn to think as experts, to think geographically. The literature in threshold concepts began with ideas at the crux of disciplines that students found troublesome, such as opportunity cost in economics (Perkins, 2006). Since the publication of Meyer and Land's original paper in 2003 and book in 2006, the literature in threshold concepts has tended in two ways. One stream has continued to negotiate the troublesome concepts that open the door to understanding a multitude of other concepts and to thinking in a discipline. The other stream has questioned how experts, generally academics, think in

a discipline and to discovering the threshold concepts at the root of thinking like an expert in a given discipline.

The literature on the latter framing of threshold concept is somewhat esoteric but quite useful to academics. For example, a geoscientist sees the world not as a static stage but as a system of processes and feedbacks, "Geoscientists understand that the Earth is a system characterized by feedbacks between processes and among component parts" (Kastens, Manduca, Cervato, Frodeman, Goodwin et al., 2009, p. 265). A geographer needs to be a spatial thinker (King, 2006). This approach to studying threshold concepts may lead to the most elusive trait of threshold concepts, the boundedness of a discipline.

The literature on the former, on the idea that certain concepts in a discipline are thresholds that open the door to student learning, is more tangible to an undergraduate in a general education course. Once a student grasps a threshold concept in geography, the way the student sees the world should be transformed. The student should be able to integrate concepts and no longer see the world in a primitive way. By wrestling with often times counter-intuitive threshold concepts, the student should learn to think like a geographer.

Will a student who has been exposed to the idea of spatial thinking or the earth as a complex system buy into these ideas and be able to see their world in a transformative way, or do these ways of seeing come from advanced research in a discipline that an undergraduate in an introductory class will not experience? Perhaps the question of boundedness is one left for students in a discipline working on terminal degrees. Students who take only one or two introductory, or general education, classes in a discipline should, instead, focus on the tangible idea that a threshold concept opens the door to learning.

Qualitative analysis of reflective essays in world regional geography

In fall 2009, students in two sections of world regional geography completed a 25 page journal assignment. Students complete the journal over the course of the semester, and each journal is assessed formatively at three different points in the semester. Each assignment in the journal is informal writing scored with formative assessment, as best practices in college journals recommend (Fouberg, 2000; Hyers, 2001; Rebich & Gautier, 2005). The journal includes eight class entries, three current events entries, five entries on the novel *Things Fall Apart*, entries on films watched in class, entries on articles read for class and a reflective essay (Fouberg, 2000). The final entry in each student's journal was three page, typed reflective essay where they analyzed their learning in the journals.

Using the Qualrus qualitative analysis program, 80 reflective essays written by students in world regional geography were analyzed and coded. Each essay was read three times with coding completed in three separate steps. The first step, during the first read, was to select each segment of every essay where a student mentioned a core geographic concept. For example, when a student used the word globalization by saying, "In T-Shirt Travels Entry, I use the concept of globalization to explain how IMF, the World Bank and the developed countries affect the economy of Zambia," the segment was highlighted and coded as c (geographic concept): globalization.

During the second read through of the essays, each was coded for evidence of the traits of threshold concepts: transformative, irreversible, integrative, bounded and counter-intuitive. For example, when a student stated, "I can thank these journals for helping me expand my thinking abilities. After doing them, I can see the bigger picture and I'm starting to think outside of the box and looking at the world as a whole, inside of just thinking about the United States," the segment was coded as tc (threshold concept): transformative.

During the third step, each essay was coded for evidence of elements constructivists have established as essential to student learning, including personalizing information and concepts. For example, one student explained, "As I went through this class, I was able to better evaluate things and think about them at a deeper level than when I started. I also started having more fun with the journal towards the end of class, which helped me remember things more. I realized I need to let myself go and have fun with it instead of looking at it as an assignment." In this case, the segment of writing was selected and coded as personalize.

After completing the three stages of coding all 80 essays, Qualrus Tools were employed to analyze all 80 essays for instances where one code appeared and cases where two or more codes appeared for the same segment of writing. Qualrus reports the number of times each code and code pair appears in the essays.

The analysis of the Qualrus reports demonstrates that world regional geography is geared toward concept learning. Across the 80 reflective essays, students talked about 28 different geographic concepts. In 71 segments of student writing, a code for a threshold concept trait (transformative, irreversible, integrative, bounded or counter-intuitive) paired with a code for a geographic concept (Table 1). The goal was to deduce which geographic concepts are threshold concepts by analyzing the 71 segments that paired geographic concepts and threshold concept traits.

Table 1.   Paired geographic and threshold concept traits in reflective essays in world regional geography.

Concept	Counter-intuitive	Integrative	Irreversible	Transformative	Total pairs
Commodity chain	1	6	4	4	15
Core–periphery	0	6	1	2	9
Agriculture	1	2	1	0	4
Cultural landscape	0	3	0	1	4
Development	0	2	0	2	4
Desert	0	2	1	0	3
Migration	1	2	0	0	3
Remittances	1	1	0	1	3
Scale	0	0	2	1	3
World economy	0	1	1	1	3
Edge city	0	1	0	1	2
Green revolution	0	2	0	0	2
Central business district	0	1	0	0	1
Climate change	0	1	0	0	1
Colonization	0	1	0	0	1
Commodification	0	0	1	0	1
Gender	0	1	0	0	1
Identity	0	1	0	0	1
IMF/World Bank	0	1	0	0	1
Megalopolis	0	1	0	0	1
Pilgrimage	0	1	0	0	1
Place	0	0	0	1	1
Push and pull factors	0	0	0	1	1
Religion	0	1	0	0	1
Sacred place	0	1	0	0	1
Spatial distribution	0	0	0	1	1
Spatial interaction	0	0	0	1	1
Structural adjustment loans	0	1	0	0	1

The threshold concept trait that students expressed most frequently across all geographic concepts was integrative. Of the 71 segments that demonstrated a threshold concept trait and coincided with a geographic concept, 54.93 per cent described integrating concepts, 19.72 per cent described transformative concepts, 15.49 per cent described geographic concepts as creating irreversible knowledge and 5.63 per cent of the segments described concepts as counter-intuitive. None of the segments addressed the trait of boundedness.

Among the geographic concepts students listed, they most frequently described commodity chains in terms of the traits of threshold concepts (Table 1). One student explained how understanding commodity chains was transformative, "I think deeper now on little subjects, things you thought were a no-brainer and really simple, such as donating a shirt, really is complicated for the country ... Before this class I would have never thought about what happens to the shirt after you donate it. Thanks to the commodity chain and the video, this made a huge impact on the way I view things." By watching the documentary "T-Shirt Travels" and completing a journal entry where the student has to describe the commodity chain of a t-shirt after they donate it, the student's understanding of the world was transformed.

The second most frequent geographic concept that paired with a threshold concept trait was core–periphery (based on Wallerstein's three-tier structure to the world economy). Several students integrated the two geographic concepts of commodity chains and core–periphery and also saw their understanding of the concepts as irreversible and/or transformative. One student explained, "Thinking about the definitions of core and periphery, I came up with the idea that core and periphery countries need each other. I was able to put this together by realizing that countries that are periphery or core are connected through a commodity chain making them rely on each other."

Another student saw understanding the geographic concept of commodification as irreversible to their understanding of the world. "The questions in my journal entries made me have to analyze in a different way than I was used to. Although I was given questions that made me think in the beginning it took me awhile to figure out how to think in a more analytical way. I also, probably would not have been able to use the word commodification to answer a question before."

Students struggled through counter-intuitive concepts and gained deeper understanding of migration and the role of remittances:

> Applying geographical concepts to the world around me offered explanations for things I hadn't understood before. For example, I understand now how important immigration is in developing a country's economy. In the article about remittances, I wrote "the upside to this situation is that these remittances allow people to pay medical bills and school fees, build houses and buy clothes or even save enough to start a small business." Before I read this article, I didn't understand that the money legal Mexican immigrants make may be sent home to support others which in turn strengthens the economy of our neighbor across the border as well as providing a valuable service here in America.

This student's understanding demonstrated the transformative trait of threshold concepts. The student better understood remittances by reading an article handed out in class from the *New York Times* and applying the geographic concepts of remittances to migration flows from Mexico, a subject for which he had prior conceptions.

In their essays, several students described the entire course in terms of threshold concept traits, without discussing any specific geography concepts. For instance:

> Before this class, my thinking was less than average. To be completely honest, I never cared about the world and what was happening; I never would have looked through a newspaper and

took time to read it. At my age, normally kids just go on with their own lives and don't really care about much. Now going through this class, I actually read the newspaper every morning before I go to class. I never thought that I would do that in my next 30 years. I have learned so much and to be quite honest, am very proud of who I have become and how much knowledge that I have gained.

Other students also summarized their learning over the course, citing a transformed understanding of the world but not mentioning any specific geographic concepts that helped them transform their knowledge. For example, "I think that I have lived in a bubble for so long that I am not caught up with the rest of the world, and this class pushed me to discover new happenings." Another student remarked, "The world is no longer flat to me, and now has so many different faces that I want to be able to understand them."

Students learned. Students personalized information and questioned what they knew: "Putting what I have learned into my own words helps me learn more about that topic, sometimes I asked questions because I would find out that I did not know [as] much about a subject [as] than I thought I did." Will students be able to think like geographers months or years after their one course in world regional geography? They may live outside of a bubble now, in a world that is no longer flat, but will they be able to process new information like a geographer, using geographic concepts?

Words such as: "I learned to understand people of other countries and cultures in a different way, and identify with different concepts that I had never heard of. If anything, I will take away what I learned in these journals, and hopefully be able to pass these concepts on to my students in years to come" are reassuring. However, will this student think like a geographer and challenge their students to do so? Has this student's understanding of geography crossed a threshold?

The in between place: liminality

Students who are confident they now see the world differently may have shed a proverbial bubble and opened their eyes to the world around them. Opening one's eyes may mean the student has crossed a threshold into thinking like a geographer or it may mean the student is standing in the threshold, struggling with understanding. Meyer and Land call this place in the threshold liminal (2006, p. 22).

Being in the threshold is different from crossing it. In the threshold, the learner may be experiencing a "change in state or status," acquiring "new knowledge and subsequently a new status and identity within the community," at the same time they are oscillating among mimicking what they are taught, to surface learning, to misunderstanding, to understanding (Meyer & Land, 2006, pp. 22–24).

The in between, the liminal, is a place where learners can be stuck. To cope, students often practice mimicry to negotiate through the in between (Cousin, 2006). By mimicking the teacher or professor, a student looks like they grasp concepts but never gains mastery or understanding. The student in the liminal space is "engaged in the project of mastery," yet being in between does not guarantee the student will come out thinking like a geographer (Cousin, 2006, p. 4).

Cousin (2006) encourages educators to design curriculum to promote the mastery of threshold concepts by putting the threshold concepts at the center of the curriculum, listening to how students learn or negotiate the liminal space, tolerating student confusion and recognizing that learning is not linear.

Getting unstuck: metacognition

Threshold concepts grew out of the Enhancing Teaching-Learning Environments in Undergraduate Courses in the UK, and in a similar vein, the idea of teaching for understanding grew out of the Teaching for Understanding Project from the Harvard Graduate School of Education. At the end of the 20th century, the National Research Council's Committee on Developments in the Science of Learning assembled research on the science of learning from these schools of thought along with publications in educational and cognitive psychology to author *How People Learn: Brain, Mind, Experience and School* (Bransford et al., 2000).

How People Learn offers an important piece that could help shape the threshold concept literature: metacognition. Through metacognition, learners reflect on their own learning and performance. To gain understanding, students must know how learning takes place and what their strengths and weaknesses are as learners (Bransford et al., 2000). Metacognition asks students to reflect on their own thinking and gain insight into how they learn. Metacognition requires students to take ownership of their learning, and it requires learners to consciously reflect on what is working and what is not.

Metacognition helps address prior knowledge students have and encourages learners to not only personalize concepts but also to take responsibility for their own learning by questioning or challenging their existing schemata. Teachers or professors should use frequent formative assessments that "make students' thinking visible to both teachers and students" (Bransford et al., 2000, p. 24). Metacognition should help students recognize their preconceptions so that learners "build on them, challenge them and, when appropriate, replace them" (Bransford et al., 2000, p. 20).

Recognizing that the journal assignment in world regional geography is a formative assessment that reveals to the instructor how students learn and where they struggle with geographic concepts, and also recognizing that the journal assignments help students understand their own learning process, metacognition was woven into world regional geography in spring 2010. That semester, 11 students enrolled in an Honors section of world regional geography.

During the lecture on the first day of the semester, I explained educational theory on concept learning, schemata, metacognition and threshold concepts. I also explained what a threshold concept is in the syllabus and directed students to read a two page explanation of threshold concepts (Cousin, 2006). About two-thirds of the way into the semester, students chose a single geographic concept from class they saw as a threshold concept and used the five traits of a threshold concepts listed in the reading to explain why they saw the concept as a threshold concept. Each student wrote a two page essay explaining their threshold concept and why the geographic concept functioned as a threshold concept for them.

Each student then copied and pasted their threshold concept essay into Wordle.net, a free online program that generates word clouds. In a word cloud, the font size of each word is proportional to its frequency in the written work. In the word clouds generated from threshold concept essays, the largest font was typically the threshold concept, the most frequently used word in the essay. Students were instructed to create word clouds so they could visualize the ties they made among geographic concepts in their threshold concept essays.

Among the 11 students in the class, six chose cultural landscape as their threshold concept. Word clouds of two sample threshold concept essays (Figures 1 and 2) visually show the ideas, examples and words students used to describe their threshold concepts. A sample word cloud for cultural landscape (Figure 1) shows this student linked cultural
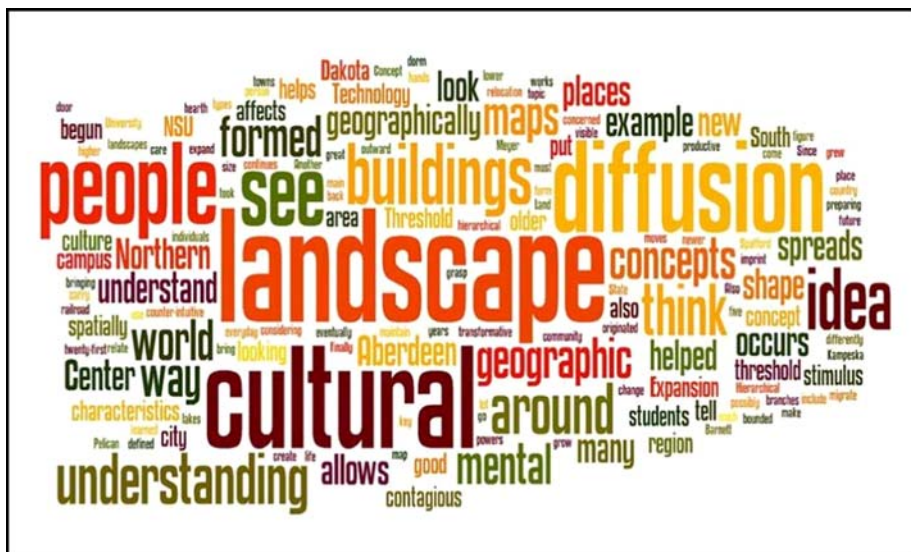
Figure 1.   Sample word cloud from a threshold concept entry on cultural landscape (produced using wordle.net).

Figure 2.   Sample word cloud from a threshold concept entry on identity (produced using wordle.net).

landscape to places and examples in the student's immediate surroundings, at the local scale, with words including Northern, Aberdeen, campus, and Dakota. In a word cloud for a student who chose identity as a threshold concept (Figure 2), the word Russia figured prominently. In this case, the student came to grasp the threshold concept of identity through the study of identities in Russia. Integrated with identity in the word cloud are several other core concepts in geography, including landscape, place and migration.

The 11 threshold concept essays written by Honors students in world regional geography were coded using the same three stage coding method and the same set of codes as the reflective essays from the previous World Geography class. The codes included five referring to traits of threshold concepts: transformative, irreversible, integrative, bounded and counter-intuitive, a code for geographic concepts with sub-codes for each geographic concept, and four codes focused on traits related to constructivist theory.

The 11 students discussed 41 different geographic concepts in their threshold concept essays and five different threshold concepts, including: cultural landscape (6), identity (1), world cities (1), globalization (1), region (1) and diffusion (1).

In each case, students personalized the threshold concept they chose, and integrated the threshold concept with other core concepts in geography. One student explained:

> Basically, the concept of cultural landscape, once I came to understand it, has acted as a springboard to the understanding of other geographical concepts (like identity, spatial interaction, distance decay, hearth, diffusion, all the different types of regions, movement, migration, and activity spaces) that help me to better perceive the world as a whole.

Using the word "springboard," the student acknowledges a fundamental, irreversible transformation to their understanding of the world.

Another threshold concept entry on cultural landscape described the concept as transformative to the way the student sees the world:

> Each concept is very important, but had I not learned about cultural landscape, I would not take note of very important things that are critical to understanding the other concepts. With my view of cultural landscape I will now look at places differently and be able to link these concepts with the places and so understand them on a completely new level.

The student continued, "...by seeing how a town is built architecturally I can catch something of that town's identity... so much that I was oblivious to before has been opened up to my once unseeing eyes!"

Students also transferred their understanding of their threshold concepts to situations outside of class settings. One student explained how the threshold concept of diffusion crept into the student's mailbox:

> I recently received a magazine in the mail that was full of clothing I had never seen. There were outrageous styles in the magazine, which to me would not be labeled as "in style." I began to look more closely at the magazine and realized the store was based out of Los Angles, California. This all at once explained the odd styles to me. The idea of the styles developed in a different country or even on the west coast, and will eventually reach South Dakota. However, it will be slowly because of distance decay. South Dakota is a great distance away from the hearth of the innovation of the styles, and most likely the idea will spread hierarchical. Those closely linked cities and places will first get the wave of the new idea. The idea will eventually reach South Dakota, proof is the magazine.

The student applied the threshold concept of diffusion outside of the classroom and also integrated the concept with other geographic concepts, including distance decay and hearth.

Through metacognition, students became aware of how threshold concepts integrated with other concepts and improved their learning. One student explained how understanding identity gave a better grasp of cultural landscape "Another reason identity is a threshold concept for me is that it relates to another geographic concept we've talked about: cultural landscape. Knowing the character of a person or group of people really helped me understand the cultural landscape of some areas we talked about in class."

Through the metacognition imbedded in the formative assessment of the journal and the threshold concept essay, students acknowledged their preconceptions and recognized

how their threshold concept helped them better understand the world. One student explained a preconception of Africa, "Before this class, I pretty much just saw Africa as a huge desert with absolutely no technology. I knew they had cities and stuff, but that was about the extent of my knowledge." Through consciously thinking about this threshold concept, region, the student broke down a preconception of Africa and recognized that regions are in "one's own mind." The student acknowledged, "A lot of the regions are the same for most or all people, but a lot of regions are definitely different depending on where you live, and that idea really opened my thoughts up to others places in the world and how they view world geography, because before this class I think I just viewed geography from an American view."

Conclusion

Threshold concepts open the door to student learning, to thinking as a geographer in a world regional geography class. This study questioned whether students find their own threshold concepts by reflecting on a journal in world regional geography or if students need to be taught metacognition and asked to analyze their own learning and discover their threshold concepts.

Through qualitative analysis of 80 reflective essays of world regional geography journals, this study demonstrated the importance of formative assessment in personalizing, applying and integrating geographic concepts. Through qualitative analysis of 11 threshold concept essays in journals written by Honors students in world regional geography, this study demonstrated that metacognition both reveals to the teacher how students are learning and integrating concepts and also illustrates for the learner how a threshold concept can help them recognize preconceptions, integrate concepts, transform their thinking and see the world in a new light.

When asked to write reflective essays on journal entries over a semester's time, 80 students mentioned 28 different geographic concepts. These concepts overlapped in 71 instances with threshold concept traits. When 11 students in an Honors section of world regional geography were asked to read about threshold concepts and employ metacognition to analyze their own learning, the students focused mainly on concepts, discussing 41 geographic concepts and using threshold concept traits to describe how a single geographic concept served as a threshold concept for them.

Although the content of the world regional geography classes was the same, the 80 students writing reflective essays (without a metacognition component or a threshold concept essay) came up 28 different geographic concepts while the 11 Honors students writing threshold concept essays came up with 41 different geographic concepts. The 80 students had 0.35 geographic concepts per capita, while 11 Honors students had 3.72 geographic concepts per capita. At least part of the difference is from the metacognition component of class and threshold concept reading and assignment, which urged the Honors students to think about how their threshold concept helps them integrate other geographic concepts. Another part of the difference in concepts per capita may be due to the academic standing of the students with 80 students in two regular sections of world regional geography and 11 in an Honors section. The smaller Honors section also allowed for more individual attention from the faculty member to the students and also gave the students more time for class discussion and questions.

Recognizing the role of liminality and acknowledging the recursive nature of learning troublesome concepts, this study suggests combining metacognition and geographic concepts to enable students to discover their threshold concepts in geography.

Metacognition also aids teachers in identifying threshold concepts that trigger transformational change in learners and to create formative assessments that improve student thinking and learning in geography.

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