



Transdisciplinary Pedagogy: A Competency Based Approach for Teachers and Students to Promote Global Sustainability

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Abstract

Implementing transdisciplinary-learning strategies is paramount to contemporary learning goals of global sustainability. If educators are dedicated to creating complex critical thinkers that will create solutions to global problems, then the institution of education must reimagine the teaching and learning competencies that occur in the 21st century classroom. Expectations of learning processes and goals are altered when disciplines from various theoretical backgrounds merge. The theory of transdisciplinarity will be discussed, next, 21st century teaching and learning competencies will be defined and exemplified, finally, the connection between the theory of transdisciplinarity and the competencies that teachers and students must possess in order to create global sustainability in our highly-connected society will be explained.

Keywords: Transdisciplinary Learning, Global Sustainability, 21st Century Learning Competencies

Introduction

A paradigm shift is occurring in P-21 schools. Educators are recognizing the vital significance of designing a transdisciplinary curriculum in order to promote both teaching and learning skills of the 21st century. Implementing transdisciplinary-learning strategies is paramount to the contemporary learning goals of promoting global sustainability through content area instruction. If educators are dedicated to creating complex critical thinkers that will create solutions to global problems, then the institution of education must reimagine the teaching and learning competencies that occur in the 21st century classroom.

Competencies that teachers must possess in order successfully meet 21st century standards and expectations are the *same* characteristics that we expect our students to

acquire throughout the learning process. Teachers must model learning theories through the curriculum development of real-world problem identification, classification, definition, and ultimately solution. The most effective and efficient way to promote and develop a curriculum dedicated to global problem solving is through transdisciplinarity. Burger and Kamber (2003) argue that transdisciplinarity evolved from real, complex and socially relevant problems that require knowledge from across disciplines to merge in order to reach sustainable solutions. When disciplines from various theoretical backgrounds merge structures, demands, and expectations of learning processes, goals are altered. Learning modalities shift from the disciplinary specific subject-driven activity where the student's identity is that of knowledge receiver and the teacher's role is that of knowledge deliverer, to a much more fluid and highly interactive process where the student becomes the producer of new knowledge and the teacher becomes the interactive learning designer (Park and Son, 2010). First, the theory of transdisciplinarity will be discussed in detail and will be compared to other learning theories often confused with transdisciplinarity: multidisciplinary and interdisciplinarity.

Multidisciplinary Learning

Multidisciplinary learning transpires when students from diverse disciplines communicate various approaches to problem solving from a discipline specific orientation. The objective is to gather ideas from various disciplines like economics, history, education, technology, entrepreneurship, etc. to promote a launching point of new ideas that will hopefully lead to solutions within a specific discipline. Students discuss, debate, and compare during brain storming sessions, and ultimately gather ideas to take back to their own specific disciplines, but do not necessarily share common solutions. Instead, separate, discipline specific solutions are created. Disciplines remain independent within the various represented subject areas in order to attain discipline specific goals (Garner, 1995). Park and Son (2010) argue that the limitation of multidisciplinary learning is that “students experience sharing communication more than collaborative problem solving” (p. 83).

Interdisciplinary Learning

Interdisciplinary learning takes the intrinsic component of communication from multidisciplinary learning and propels its energy into a structure that promotes collaboration. Collaboration, by definition, requires a working group to realize mutual goals. Interdisciplinary working groups not only identify common characteristics of identified problems from various disciplines, but also focus on the interactions among those disciplines. The limitation, pointed out by Rosenfield (1992) is that within an interdisciplinary working group, the members work cooperatively but retain discipline specific perspectives.

Transdisciplinary Learning

The epicenter of transdisciplinary learning is the role of the student. Students engaged in transdisciplinary learning use a shared working “conceptual framework that draws together concepts, theories, and approaches from the parent disciplines” (Rosenfield, 1992, p. 1351). This shared conceptual framework facilitates collaborative decision making through the entire learning process, from problem identification all the

way through to viable solution discovery. The students not only listen to the theoretical frameworks suggested by their peer disciplines, but transfer the knowledge gained from outside disciplines to their own specific subjects. Then, the working group develops a sub-framework from which to make decisions, and ultimately creates solutions for the identified problem. This model gives students the necessary platform to collaborate and build consensus around given topics.

Park and Son (2010) precisely define the difference among multidisciplinary, interdisciplinary, and transdisciplinary learning through identifying the given activity, the student identity, and the teacher identity. The researchers classify multidisciplinary as discipline-to-discipline specific where the student is the knowledge consumer and the teacher is the knowledge facilitator. They contend that interdisciplinary learning is learner collaboration driven where the student is a collaborator of knowledge and the teacher is a learning designer. Finally, they distinguish transdisciplinary learning from the other two styles when they identify the activity foundation as having significant learner participation and the new knowledge is creation driven. Furthermore, the student identity is that of knowledge producer and the teacher identity is that of interactive learning designer. Transdisciplinary pedagogy is an effective learning methodology for increasing discussion about global sustainability. Transdisciplinary learning is a mechanism that promotes the levels of metacognition necessary for teachers and students to thoughtfully explore global issues.

Twenty-First Century Teaching and Learning Competencies

Transdisciplinary learning promotes an atmosphere of metacognition within the inquiry process. When teachers gather students to analyze, synthesize and evaluate global problems, the transdisciplinary model is the most robust approach. Scholz et al. (2006) argue that, “an ongoing inquiry process of individual, organizational, and societal sustainability learning is a promising approach to tackle new challenges and to foster a desirable future” (p. 246). Effective problem solving begins with a clear understanding of the necessary competencies collaborative groups must possess in order to design and facilitate a successful inquiry process. Teachers must model these skills while interacting with the students responsible for producing new knowledge. The key competencies include: critical and creative thinking, communication and collaboration, information media and technology skills, and project based curriculum development.

Critical and Creative Thinking

Huitt (1998) offers the careful definition of critical thinking as “the disciplined mental activity of evaluating arguments or propositions and making judgments that can guide the development of beliefs and taking action”. He argues that it is necessary to delineate critical thinking from other forms of thinking such as creative thinking or brainstorming. Creative thinking is designing original organizational patterns of existing thoughts or ideas, and brainstorming notes every detail that comes to one’s mind; whereas, critical thinking demands engagement of Bloom’s (1956) highest levels of critical thought: analysis, synthesis, and evaluation. As Huitt posits in his definition, critical thinking’s end result focuses the learner toward “taking action”, an integral characteristic of transdisciplinary learning. However, brainstorming and creative thinking are also essential to the transdisciplinary process. Duemler and Mayer (1988)

found that when students used techniques associated with reason and logic as well as creativity and divergence, they were more successful in problem solving. In order to reach the level of conversation required to engage students to problem solve and take action in topics related to global sustainability, teachers and students must engage in critical *and* creative thinking. The transdisciplinary learning environment is shaped when teachers give students the opportunity to discover new knowledge and make decisions influenced by a variety of discipline specific frameworks through dynamic collaboration.

Communication and Collaboration

Although Shannon (1949), in his landmark publication *A Mathematical Theory of Communication*, is credited with the initial structure of communication: transferring information from a sender to a receiver, other researchers have expanded Shannon's work to define communication as a more dynamic structure. Communication requires participants to exchange facts and opinions, engage in discourse, and ultimately reach agreement. Effective communication includes the following components: 1) the sender, 2) ideas, 3) encoding, 4) communication network, 5) the receiver, (6) decoding, and (7) feedback. When communication is flowing effectively, the participants transfer roles between sender and receiver and make detailed notes within the communication network. Communication disruption occurs when barriers arise within the communication structure. Jureddi and Brahmaiah (2016) identify four types of communication barriers: language, physical, attitudinal, and psychological barriers.

When a group structure is formed from a variety of disciplines, *language communication* can easily become a barrier even if all group members speak the same language. Communication breakdown occurs with the use of discipline specific jargon and highly specialized language. The communication channel between the sender and the receiver will be interrupted at the moment misunderstanding or confusion emerges. For effective transdisciplinary communication to take place, it is essential for the message senders to continually define and exemplify discipline specific language. Additionally, group receivers must feel safe to interrupt the sender in the collaborative environment in order to seek clarification. Geographic distance may create a *physical barrier* to effective communication. Even with high capacity voice-over-internet protocols like Skype, barriers can develop: loss of internet connection, loss of power, weak feed, interrupted or frozen streaming, etc. Jureddi and Brahmaiah (2016) argue that "attitudinal barriers in communication may result from personality conflicts, poor management, and resistance to change or a lack of motivation" (p. 115). An *attitudinal barrier* may appear during a discussion when a level of hubris surfaces as the sender speaks about a familiar topic that the receivers are less familiar with. The sender's ego becomes evident when the receivers begin to demonstrate clear physical signals of confusion through facial expression and body language, yet the sender continues to speak without pause. *Psychological barriers* of communication stem from the mental and behavioral characteristics of the participants. When a disagreement occurs, anger or frustration may erupt. If participants lose their temper or leave the conversation, communication is broken.

Teachers must consider these potential barriers to effective communication when facilitating transdisciplinary learning. Group members come to the discussion from a variety of backgrounds, disciplines, and experiences. These differences have the

potential to interrupt the positive discourse of the working group. Developing tools of effective collaboration will assist teachers in facilitating the communication process. Teachers must model effective methods to overcome obstacles that impede collaborative communication. Oakley et al. (2004) suggest teachers develop a *policy statement* and an *expectation agreement* at the initial group meeting to support productive discussion and prevent barriers from manifesting. The research suggest,

the policy statement provides guidance on effective team functioning, outlining different team roles and the responsibilities that go with each role, procedures for working on and submitting assignments, and strategies for dealing with uncooperative team members. The *Expectations Agreement* serves two purposes: it unites the team with a common set of realistic expectations that the members generate and agree to honor, and it also serves as a ‘quasi-legal document’ to prevent students from making invalid claims about what they were supposed to do (p. 13-14).

Policy statements might include but are not limited to: 1) creating member roles within the group, for example recorder, coordinator, fact checker, time keeper, reporter (rotating roles throughout the process is recommended), 2) designing an agreeable timeline, and 3) instructor consultation (Oakley et al., 2004). Felder and Brent (2000) offer an example of an expectation agreement:

Team Expectation Agreement

On a single sheet of paper, put your names and list the rules and expectations you agree as a team to adopt. You can deal with any or all aspects of the responsibilities outlined above—preparation for and attendance at group meetings, making sure everyone understands all the solutions, communicating frankly but with respect when conflicts arise, etc. Each team member should sign the sheet, indicating acceptance of these expectations and intention to fulfill them. Turn one copy into the professor, and keep a remaining copy or copies for yourselves.

These expectations are for your use and benefit—they won't be graded or commented on unless you specifically ask for comments. Note, however, that if you make the list fairly thorough without being unrealistic you'll be giving yourselves the best chance. For example, "We will each solve every problem in every assignment completely before we get together" or "We will get 100 on every assignment" or "We will never miss a meeting" are probably unrealistic, but "We will try to set up the problems individually before meeting" and "We will make sure that anyone who misses a

Technology and Information Media Skills

Technology and information media in an educational setting go hand in hand. One needs the other to function properly and efficiently. Technology includes a wide array of tools, hardware and software, that support the creation of informational media. Information media is produced using various types of technology that disseminates the information through the text, video, audio, and the multitude of on-line communication

outlets: websites, podcasts, chat rooms, virtual environments, blogs, social media, etc. Wright (2008) argues that, “technology is more than just the media appliances used to deliver content. Technology also includes the pedagogy guiding that use of the media; it includes the teaching strategies driven by stated objectives; it drives toward desired outcomes, using a healthy mix of experiences, activities, and tasks. It mingles collaboration with reflection”. Twenty-first century students are digital natives equipped with technological skills. Today’s toddlers are swiping left and right, tapping screens to make decisions, and downloading applications before the age of three. Twenty-first century teachers, on the other hand, must develop a technological skill set that keeps pace with the rapid development of the tech industry and the tech savvy student. Palmer is an educator who blogs for Edutopia.com. Palmer (2016) blogs about the skills necessary for the successful twenty-first century teacher. She encourages teachers to learn new technologies, create global communities in the classroom through the Internet, and find usefulness in students’ personal devices in the classroom. Palmer advocates for teachers to blog, chat, tweet, and link to the on-line community. She urges contemporary teachers to use available technology to create a learning atmosphere that promotes classroom, community, country, and global connectivity.

Technology and the media created through the use of technology is a platform for transdisciplinary learning. By definition, transdisciplinarity promotes students from diverse disciplines to engage in productive problem solving. Educational institutions have the mechanisms to create learning communities that promote collaboration from a variety of perspectives and foster opportunities for developing solutions to global problems. Technology allows for a transdisciplinary group to never meet face-to-face. Synchronous and asynchronous learning tools support such communication through on-line channels. Imagine the problem solving team that is comprised of members from various classrooms, from various schools, from various states or even countries around the globe. Technology and informational media can allow an American student from Flint Michigan facing clean water challenges to communicate, research, collaborate, and ultimately problem-solve with a student from Malta, Singapore, or Kuwait facing similar problems. Creating global communities and partnerships through transdisciplinarity is possible through the use of technology and information media.

Project Based Curriculum Development

Learning by doing is by no means a new concept to the education arena. John Dewey began ruminating on the idea a century ago. He is famously quoted for saying, “give the pupils something to do, not something to learn; and the doing is of such a nature as to demand thinking; learning naturally results” (Dewey, 1916). Project based curriculum development is an essential characteristic of transdisciplinary learning. Creating learning environments that require students to problem solve through short and long term projects is the foundation for the collaboration of diverse disciplines. The classroom project is the mechanism that connects all other essential skills necessary for transdisciplinarity to function. Authentic critical and creative thinking, genuine communication and collaboration, and the integration of technology and information media are all embedded in project-based curriculum. When project teams are organized, group roles assigned, and problems topics identified the classroom can be transformed into a space where students have an opportunity to become producers of new knowledge

while the teacher takes on the role of interactive learning designer. The project based classroom using a transdisciplinary approach to learning allows the teacher to design a curriculum that promotes the highest levels of critical thinking requiring students to identify global problems ranging from, but not limited to, economic disparities, environmental hazards, social issues, healthcare epidemics, and political systems. The transdisciplinary approach to teaching and learning will ultimately lead the collaborative working group to design possible solutions that could potentially impact future generations.

Global Sustainability

The epicenter of current education curriculum at the national, state, and local levels is the acute development of metacognitive skills. Educational standards designers recognize the importance of students developing high order thinking skills for the purpose of becoming future global problem solvers. One of the most significant challenges facing future leaders is global sustainability. Through strategically targeted skill development, educators have the power to cultivate students' metacognitive skills in order to successfully tackle many of the earth's most challenging issues. Examples of global concerns facing future generations include preserving ecosystems while continuing to progressively support economic expansion in developing countries, preserving biodiversity while researching methods to provide clean water, air and food around the world, and the creation of affordable healthcare initiatives while maintaining acute sensitivity to natural global infrastructures. Futureearth.org (n.d.) identifies various challenges and questions that face current and future generations concerned with global sustainability.

1. What insights and innovations in basic earth, biological and social sciences are most important to the environmental bases of sustainable development?
2. What are the patterns, trade-offs and options for the equitable and sustainable use of resources and land, and how can we ensure sustainable access to food, water, clean air, land, energy, genetic resources and materials for current and future populations?
3. What are the implications of global environmental change, including climate change, for food, water, health, human settlements, biodiversity and ecosystems? How can climate services, ecosystem management and disaster risk assessment reduce these impacts and build resilience?
4. What are the links between biodiversity, ecosystems, human wellbeing and sustainable development?
5. How socially and environmentally effective, efficient and equitable are alternative approaches for conceiving, measuring and implementing development projects and initiatives?

Imagine transdisciplinary teams approaching these issues given the proper training and access to global communication networks among schools around the world. Solutions to these questions will be most robust when a wide variety of problem solvers from diverse backgrounds join knowledge, research strategies, and scientific skill. When transdisciplinary approaches to learning and problem solving are utilized strategically, and when educators and learners are well versed twenty-first century teaching and

learning competencies, opportunities to discover answers to questions such as these are more attainable and realistic.

Conclusion

Transdisciplinary teaching is the most effective approach to support teachers' and students' successful integration of a varied discipline discussion in order to create global sustainability in our highly-connected society. Twenty-first century problem solving requires a cadre of disciplines working together to analyze, synthesize, and evaluate today's global conversations. Idea sharing across and within disciplines is a reality when teachers and students have the skills necessary to create meaningful dialogue that supports and transcends a variety of subjects. Effective critical and creative thinking skills set a foundation to begin discussions involving a variety of disciplines that may not be familiar with each other's subject matter, research methods, or approaches to solution driven discussions. Communication and collaboration are at the heart of any problem solving team. When team members are versed in methods to demonstrate respect for group members, convey messages concisely, and use appropriate tone and body language, ideas can be shared in a safe and non-judgmental environment. When people feel safe and respected, communication and collaboration will flourish. Technology and information media skills are the mechanics through which the dialogue will occur. Finally, a project-based methodology to curricular design is the most desirable framework for a transdisciplinary approach to problem solving. Problem based curricular design promotes the highest levels of all necessary skills required to motivate a working group into concentrated levels of inquiry.

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Dr. Theoni Soublis' current research interests include transdisciplinary education, social justice education, public school law and ethics, and literacy across the curriculum.