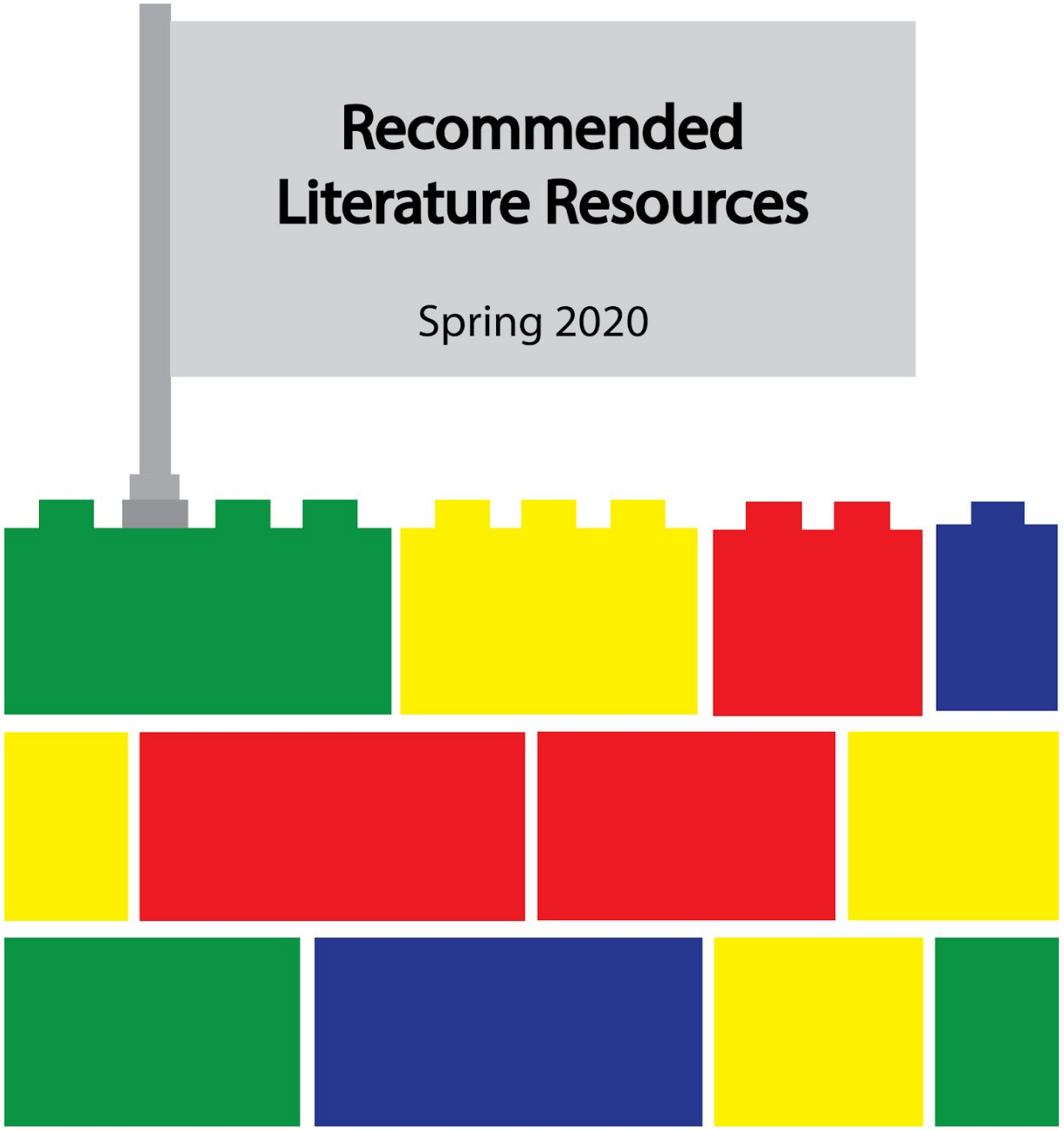
Recommended Literature Resources

Spring 2020



Authors: Vicky McDermott '20, Julia Benton '22, Allison Basore '20, Mason Grabowski '22
Advisor: Yevgeniya (Zhenya) V. Zastavker

Background

Over the 2020 Spring semester, a team of Olin students engaged with SoTL (Scholarship of Teaching and Learning) as a way of supporting and, in some cases, co-designing workshops with faculty for the Summer Institute 2020. SoTL is an emerging field that considers the mutual relationship between teaching and learning. As Poole and Simmons (2013) explain,

> "The Scholarship of Teaching and Learning (SoTL) involves post-secondary practitioners conducting inquiry into teaching and learning processes in higher education contexts." As McKinney (2006) describes, 'the scholarship of teaching and learning … involves systematic study of teaching and/or learning and the public sharing and review of such work through presentations, performance, or publications' (p. 39). Hutchings and Shulman (1999) further clarify that SoTL 'requires a kind of "going meta", in which faculty frame and systematically investigate questions related to student learning' (p. 13). The overall intention of SoTL is thus to improve student learning and enhance educational quality.

The student team specifically focused on understanding the current landscape of SoTL in engineering education. The team also delved into research on a variety of pedagogical practices. One of this effort's final deliverables was formulation of the literature review that may be used by the Summer Institute workshop designers and facilitators as well as by the Summer Institute participants. In producing this document, the student team has also drawn upon their personal academic experiences, which range from participation in Science, Engineering, Technology and Mathematics (STEM) education research at Olin, drawing lessons from a variety of Olin courses (e.g., Teaching and Learning, Contemplative Science, and Quantitative Engineering Analysis), as well as interviews with faculty who designed previous Summer Institute learning experiences. The student team hopes that this document will be useful to a range of audiences interested in engaging with SoTL in engineering education.

References:

• Hutchings, P., & Shulman, L. E. (1999). The scholarship of teaching: New elaborations, new developments. Change, 31(5), 10–15.
• McKinney, K. (2006). Attitudinal and structural factors contributing to challenges in the work of the scholarship of teaching and learning. New Directions for Institutional Research, 129 (Summer), 37-50.
• Poole, G., & Simmons, N. (2013). The contributions of the scholarship of teaching and learning to quality enhancement in Canada. In G. Gordon, & R. Land (Eds.), Quality enhancement in higher education: International perspectives. London: Routledge.

Goals and Assessments Synthesis Matrix

Sources (below) Themes (across)	**Bias & Consistency in Grading**	**Methods of Assessment**	**Interesting things to Assess**
Andrade, Heidi. (2005). Teaching With Rubrics: The Good, the Bad, and the Ugly. College Teaching. 53. 27-31. 10.3200/CTCH.53.1.27-31.	rubrics should be cross checked for reliability, validity, equity		
Borrego, Maura & Newswander, Chad & McNair, Lisa & McGinnis, Sean & Paretti, Marie. (2009). Using concept maps to assess interdisciplinary integration of green engineering knowledge. Advances in Engineering Education. 2.	disciplinary bias in scorers, consensus scores based heavily on green engineering faculty who also was an instructor for the course	concept maps completed at beginning and end of course	
Yorke, Mantz. (2003). Formative assessment in higher education: Moves towards theory and the enhancement of pedagogic practice. Higher Education. 45. 477-501. 10.1023/A:1023967026413.		peer & self assessment, diaries, learning journals, & portfolios	
Kapitanoff, Susan. (2009). Collaborative Testing: Cognitive and Interpersonal Processes Related to Enhanced Test Performance. Active Learning in Higher Education. 10. 10.1177/1469787408100195.		collaborative testing (decreased anxiety and students enjoyed)	
Ahn, Benjamin & Cox, Monica & London, Jeremi & Çekiç, Osman & Zhu, Jiabin. (2014). Creating an Instrument to Measure Leadership, Change, and Synthesis in Engineering Undergraduates. Journal	feedback from peers and mentors on engineering leadership is subjective & too individualized	electronic portfolios and feedback from peers and mentors	engineering leadership, change, and synthesis skills

of Engineering Education. 103. 10.1002/jee.20036.			
Slevin, J. (2001). Engaging Intellectual Work: The Faculty's Role in Assessment. College English, 63(3), 288-305. doi:10.2307/378994	Regularization of curriculum leads to students being treated as “basically homogenous”... goes hand in hand with standardized assessment methods.	Assessments should be found within and during the learning process, not outside and afterwards	Author comes from English background, not engineering. Exploring education research more broadly… may bring different ideas to faculty?

GAPA/Learning Styles

Sources (below) Themes (across)	**Cooperative Learning**	**Problem/Project Based Learning**	**Student Interaction w/ Instructor**
Felder, Richard & Brent, Rebecca. (2010). The ABC'S of engineering education: ABET, Bloom's taxonomy, cooperative learning, and so on. Proceedings of the 2004 Annual Conference and Exposition on American Society for Engineering Education.	maximization of the benefits of teamwork is with cooperative learning, using (1) interdependence, (2) individual accountability, (3) face-to-face interactions, (4) facilitation of interpersonal skill development, and (4) self-assessment	-should you present students with problems before they have been taught everything they need to know to solve the problems? -potentially leads to a much "greater mastery of the knowledge and skills the instructor wishes to impart."	
Zhou, Chunfang & Kolmos, Anette & Nielsen, Jens Dalsgaard. (2012). A Problem and Project-Based Learning (PBL) Approach to Motivate Group Creativity in Engineering Education. International Journal of Engineering Education. 28. 3-16.	-creativity in the collaborative process goes beyond the individual -investigation of "interpersonal interactions that demonstrate collaboration involves an intricate blending of skills, temperaments, effort and sometimes personalities to realize a shared vision of something new and useful"	-results of Chemistry students self-evaluation after trialing Problem Based Learning: "students became more positive and confident in problem-solving and group work as the semester progressed… enhancing chemistry students' creative thinking ability, self-regulated learning skills and self-evaluation." -problem based learning can motivate group creativity	
Jennifer M. Gore (1995) On the Continuity of Power Relations in Pedagogy, International Studies in Sociology of Education, 5:2, 165-188, DOI: 10.1080/0962021950050203	-"Exercising power techniques makes it easier for students to categorize themselves and each other (i.e. 'slacker' or 'conscientious'), without questioning the frameworks that put them there." This can lead to a sense of disconnectedness with teammates and the course as a whole, creating a new barrier to cooperative learning.		-attempts to identify "micro-level techniques of power", and how they influence the learning environment from the student's perspective.. -eight techniques of power: surveillance, normalisation, exclusion, classification, distribution, individualisation, totalisation, and regulation.

Ronan O'Brien, Oliver McGarr & Raymond Lynch (2020): Students' perceptions of lecturer power and authority in a higher education PBL business programme, Teaching in Higher Education, DOI: 10.1080/13562517.2020.1725881		-When assignments and deliverables aren't clearly defined, students can perceive comments or suggestions from educators as rigid guidelines.	-perceptions of power can greatly influence sense of autonomy, hurting motivation and engagement with it.

Personas and Pedagogies

Sources (below) Themes (across)	**Student Engagement**	**Role of the Teacher**	**Different Pedagogy Types**	**Motivation Behind Different Pedagogies**	**Implementation of Pedagogies**
Smith, Karl & Sheppard, Sheri & Johnson, David & Johnson, Roger. (2005). Pedagogies of Engagement: Classroom-Based Practices. Journal of Engineering Education. 94. 10.1002/j.2168-9830.2005.tb00831.x.	-measured through National Survey of Student Engagement (NSSE) sent to first years & seniors -interaction both among students & between students & faculty affected education outcomes more than any other environment variables -student isolation & alienation are best predictors of failure	-designer and facilitator of learning experiences and opportunities rather than imparter of knowledge	-traditional presentation/lecture learning, cooperative learning (unlike collaborative in that it has individual accountability), problem based learning (as opposed to subject-based learning) -pedagogies of engagement: cooperative, problem based, service learning, learning communities, co ops, etc.	-students benefit both from teaching & being taught - underlying precept of problem based and collaborative learning is interdependence -student gains in interactive engagement classes much greater than in lectures -forming relationships more important than IQ -cooperative learning helps with critical thinking, higher level reasoning, and teamwork skills	-informal cooperative learning - interspersed turn to your partner activities or discuss what you are learning with group around you sessions -formal cooperative learning - groups that stay together longer, need positive interdependence (sink or swim together), individual accountability (peer & self assessments, individual exams, etc.), teamwork (roles..) -cooperative base groups - long term groups to support each other's learning
Sellars, Maura. (2012). Teachers and Change: The Role of Reflective Practice. Procedia - Social and Behavioral Sciences. 55. 461–469. 10.1016/j.sbspro.2012.09.525.		-teachers (rather than policy makers, the curriculum developers, or education authorities) are the most powerful, durable, and effective agents of educational change)			

		-“the quality of the educational changes that teachers have the skills and opportunities to effect will only be as reliable and proficient as the teachers’ individual capacities for reflective practice and the development of self knowledge. These aspects of teacher development have, historically, been largely overlooked in the preparation and promotion of effective teachers”			
Treagust, D. and Tsui, C. 2014. General Instructional Methods and Strategies, in Lederman, N. and Abell, S. (ed), Handbook of Research on Science Education Volume II, pp. 303-120. USA: Routledge.	-questioning students without wait time is often unproductive -encouraged in interactive & cooperative learning activities	-instructional methods can be organized based on amount of direct control teachers have -in demonstrations, teacher is a mediator of student learning & interpreter of content	-demonstrations, classroom explanations, questioning, forms of representations, group/cooperative learning, deductive-inductive approaches	-predict observe explain (POE) in demonstrations can increase cognitive involvement, engage students, foster classroom social interactions -questioning can improve quality of classroom discourse	-method for collaborative learning - jigsaw classroom, individuals from various expert groups come together
P. Johnson, D. Port and E. Hill, "An Athletic Approach to Software Engineering Education," 2016 IEEE 29th International Conference on Software Engineering Education and Training (CSEET), Dallas, TX, 2016, pp.	-students don't come to passively listen to instructor imparting information, instead to participate in structured activities	-serves as the "coach" and motivator to keep students training & engaged -instructor as a coach rather than adversary or taskmaster	-athletic software engineering - course is series of skills gained through workouts -lecture based learning, project based practicum, flipped classroom (videos prior to class then active	-athletes view time as a constrained resource & the best athletes do not suffer from distraction during training & competition -students and instructors both enjoy the "workout" pedagogy	-structure curriculum as skills to be mastered not things to be memorized, create training problems with min and max time to be taken, give time to practice until students can solve the problem in specified amount of time

8-17, doi: 10.1109/CSEET.2016.29.			learning opportunities in class, but little motivation to watch videos ahead of time)	-fewer students fail & they leave with higher competence and confidence -redo training problems helps students to gain mastery, athletic approach improves focus, makes people comfortable with pressure	-create workouts of the day that students all do at the same time and train for ahead of time, also do them as hw and watch reference videos if they can't finish in time; provide public data on class (not individual) performances, separate learning from performing (reference materials & practice problems to do to prepare)

Teaming Synthesis Matrix

Sources (below) Themes (across)	**Social Context & Team Makeup Matters for Teams to Function Well**	**Social Interactions on teams**	**How to teach/improve teaming experiences**	**Advantages**	**Drawbacks**
Tonso, Karen. (2006). Teams that Work: Campus Culture, Engineer Identity, and Social Interactions. Journal of Engineering Education. 95. 10.1002/j.2168-9830.2006.tb00875.x.	-article suggests that the organization of academic life on this engineering campus—the campus culture—played a key role in how team's operated	-respectful social interactions is critical and diverse	-explicitly teaching about it -organizing teams to reduce conflict -balanced gender composition (or all of one gender) -improve trust -incorporate peer feedback	-improve learning in several contexts	-boys participate more than girls -students often overrate their teamwork skills
Menekse, M., Purzer, S. & Heo, D. (2019). An investigation of verbal episodes that relate to individual and team performance in engineering student teams. IJ STEM Ed 6,7. https://doi.org/10.1186/s40594-019-0160-9		-the social and discursive dynamics of a team can impact these outcomes. -Results showed that different verbal episodes played a significant role on students' individual success and team performance. Students spent most of their time on question episodes, followed by reasoning episodes, and less frequently so, on conflict	-educators should monitor team interactions and promote verbal exchanges that promote student learning and positive team outcomes.		

		episodes. The linear combination of question, conflict, and reasoning episodes was significantly related to students' individual achievement scores. -They found that the teams with more balanced participation among team members performed significantly better than the teams with unequal participation among team members.			
Aeby, P., Fong, R., Vukmirovic, M., Isaac, S.R., & Tormey, R. (2019). The Impact of Gender on Engineering Students' Group Work Experiences. International Journal of Engineering Education, 35, 756-765.	gendered stereotypes appear to have an impact on attitudes and experiences of male and female students even when they are at a more advanced stage of their studies.		-engineering programs may need to be accompanied by teaching and learning strategies which seek to actively question such stereotypes and implicit biases. -promoting self-awareness by both male and female students through taking a test for implicit biases and debriefing the results with them		
Blumenfeld, P., Marx, R., Soloway, E., & Krajcik, J. (1996). Learning with Peers: From Small Group Cooperation to Collaborative Communities.	-better to have groups with high and middle achievers or middle and low or all middle		-encourage student exchanges that enhance reasoning and higher order thinking -cognitive processing such as rehearsing and organizing	improve attitudes toward school, foster achievement, develop thinking skills, promote interpersonal relations	can stigmatize low achievers, exacerbate status differences, & create dysfunctional interactions among students

Educational Researcher, 25(8), 37-40. Retrieved May 19, 2020, from www.jstor.org/stable/1176492			-perspective taking & listening to other ideas -acceptance & encouragement -use rewards that promote interdependence -train people to cooperate, resolve conflicts, appreciate each other		
Schmidt, Henk & Rotgans, Jerome & Rajalingam, Preman & low-beer, Naomi. (2019). Knowledge Reconsolidation: A Psychological Foundation for Team-Based Learning. Academic Medicine. 94. 1. 10.1097/ACM.0000000000002810.		developing close relationships with peers and teachers is a safeguard against dropout	-phase 1 - preparation phase - study and learn material individually to prepare for team based learning (TBL) session -phase 2 - readiness assurance phase - complete test on material individually & with small team (5-7 students) without consulting learning resources, usually electronic so get feedback immediately, discuss confusions and clarifications with teacher after -phase 3 - application phase - case studies and real world problems with teams, class discussion and critiques	-memory reconsolidation aims to preserve & strengthen knowledge, reactivating what you have learned several times can help with this -TBL involves 4 reconsolidation activities: retrieval, peer elaboration, feedback, and transfer	relatively little research on effectiveness