Assessing the Effectiveness of Student Oriented Learning Outlines (SOLOs) in an Equine Classroom

Kathleen S. Jogan[1], Donald M. Johnson[2], James Hammons[3] and Kelly V. Johnson[4]
University of Arkansas
Fayetteville, AR

Abstract

One learner-centered approach to teaching that has been shown to have a positive influence on student motivation to learn is use of the Student Oriented Learning Outline (SOLO). The SOLO provides students with a clear roadmap, rationale, strategy, and self-assessment of learning for each unit of instruction. This IRB-approved study sought to determine if the use of a SOLO in a University of Arkansas equine production course had a positive influence on three areas: mastery of material taught, retention of material taught, and voluntary positive student behaviors related to the course material. Thirty-one students were in the non-SOLO (control) group, and 25 students comprised the SOLO (treatment) group. Three selected units were taught to each group with the SOLO provided one-week prior for the treatment group only. Exam scores were compared utilizing Analysis of Covariance (ANCOVA). ANCOVA was used to statistically control for any effects due to differences in high school grade point averages of participants. The SOLO group significantly outperformed the non-SOLO group on each exam. Student perceptions of SOLOs were overwhelmingly positive. Students found SOLOs beneficial in preparing for class and exams. Students exhibited positive affective indicators of voluntary student behavior in each of the three SOLO sessions.

Introduction

Stakeholders in higher education demand improvement in the quality of education (Ulewicz, 2017; National Survey of Student Engagement, 2013). These expectations are warranted because of the knowledge and skills graduates will need to obtain to maintain successful careers in our information-based global society (Hart Research Associates, 2015). Land grant institutions are under enormous legislative and stakeholder pressure to improve student retention rates, especially in science fields (Archibeque-Engle and Gloeckner, 2016). Resources in the form of capital, laboratory facilities, and faculty time are expended educating students in these fields, and when students either do not graduate or switch majors, this investment is lost.

There are a number of factors that influence student retention (O'Keeffe, 2013). These factors include generational student characteristics, past experiences with education, baseline knowledge of topic, and classroom environment. Faculty must acknowledge these factors and the role they play in the education process. These factors meld together, and faculty should be cognizant of the interplay between them. Two additional factors influencing student success are the lack of support systems and the ways college students use their time. Utilizing data obtained from The Education Trust, Greene and Forster (2003) determined that more than half of the students who graduated from high school entered college, however many were unprepared for college level academics (National Center for Public Policy and Higher Education, 2010). In addition to not being prepared for college, many of today's undergraduate students are pressed for time. Students often work full or part-time jobs that are required to pay for the high cost of living and school. Mortenson (2011) found that students spent only 3.3 hours per weekday attending classes, studying, doing homework or participating in research.

Although there are many factors affecting student success that cannot be directly influenced by faculty, there are specific actions faculty can take that directly influence student learning. Fortunately, classroom culture and climate are largely under the direct control of faculty and greatly influence student outcomes. Faculty members can develop clear unit objectives, provide transparent grading systems with rubrics, state convincing reasons why learning objectives are important, include pre-assessments to determine student readiness, identify efficient and effective ways for students to master each objective, and develop objective-referenced assessment measures creating a learning-oriented environment that encourages student success (Gallant, 2008, 2017). The proper development of course materials positively affects student motivation and outcomes and student motivation directly determines the success of a learning activity (Yilmaz et al., 2017). Through the use of pre-tests and prerequisites, faculty can make sure that students possess the entry knowledge, skills and abilities they need to succeed. Using formative assessments, which are not part of the course grade, prior to testing allows faculty members to determine where students have deficits and where they will need additional assistance, thus ensuring that more students succeed.

[1]ANSC Dept.; 479-236-6300; kjogan@uark.edu
[2]AECT Dept.; 479-575-2439; dmjohnso@uark.edu
[3]HIED Dept.; 479-575-2000; jhammons@uark.edu
[4]NURS Dept.; 479-575-6330; kvjohnso@uark.edu

The opportunity for students to demonstrate their ability and apply what they have learned is a key factor in student learning and engagement (Eison, 2010). Faculty should also strive to use techniques to increase learning efficiency by improving the gains-to-effort ratio (Hu and Kuh, 2003). This idea comes from the economic principle of efficiency. If the effort and time that students spend on task is a critical factor determining student learning, faculty can increase student success by making every minute that students are in class or studying count (Joyner and Molina, 2012; Hu and Kuh 2003). One learner-centered approach to teaching that has been shown to have a positive influence on student learning is the use of a Student Oriented Learning Outline (SOLO).

The SOLO is a systematic approach to teaching that begins with unit topics, provides general learning goals, and offers a convincing rationale for learning. It then directs students to effective ways to learn each objective and provides them with a non-graded means of determining if they have learned, prior to being evaluated for grading purposes (VanArsdale and Hammons, 1998). SOLOs provide faculty and students with clear map for instruction and learning.

Much of the research concerning the effectiveness of SOLOs was done in the 1980s, with four research studies and five identified dissertations covering the two decades from 1980 through 2000. VanArsdale and Hammons (1998) described the history, components and use of the SOLO and presented findings based on using two SOLOs in a health assessment course at The University of Arkansas for Medical Sciences in Little Rock, Arkansas. A total of 50 students utilized the SOLOs; 100% reported that they found the SOLOs useful; 96% reported that SOLO materials would be useful if provided for other units (VanArsdale and Hammons, 1998). The authors further reported "*the mean score on the portion of the examination based on the SOLO was 92% and was the highest mean score in any examination given in the course*" (VanArsdale and Hammons, 1998).

Emery and Kalscheur (2000) developed and implemented a SOLO which was used for four semesters with a total of 88 undergraduate occupational therapy students enrolled in Research Methods courses utilized these SOLOs. Emery and Kalscheur (2000) reported that the use of the SOLO not only helped to promote student learning, but that the students perceived utilizing SOLOs as helpful. Additional research studies have shown that attitudes concerning use of SOLOs were positive (Johnson, 2016; Hyndman, 1995; Robinson, 1983) and that use of SOLOs decreased student anxiety (Van Horn, 1989). According to Bain (2011), the best college teaching not only produces cognitive growth, but also increases student's interest, appreciation, and curiosity about the subject. Outcomes such as these are in the affective domain and are generally evaluated by observation of student behaviors such as using course content in out-of-class situations or through additional, non-required study or reading on course-related topics.

The purpose of this quantitative study was to determine if there was a positive relationship between the use of SOLOs and three measures: mastery of material taught, retention of material taught, and voluntary student behaviors related to course material. Four types of data were collected in an effort to determine if utilizing SOLOs: a) made significant differences on performance for three unit exams: colostrum, Immunoglobulin G (IgG) and emergency horse care; (b) influenced the retention of material as measured by unit exam scores; (c) were perceived as useful by students when preparing for exams and determining what they were expected to learn; and (d) produced evidence of voluntary affective indicators by students.

Materials and Methods

The University of Arkansas Institutional Review Board approved the study protocol. A consent form that explained the research and that refusal of participation would not affect the relationship with the instructor or ability to participant in the course provided to the participants. Participants were given the opportunity to sign the consent form or opt out of the study. The researcher developed all materials for this study and pilot-tested the SOLOs and exam questions.

The treatment variable for this study was the use of SOLOs as a teaching methodology for specific units in a horse production course. The dependent variables were mastery and retention of SOLO material as measured by the unit exams. Additionally, assessments of the usefulness of SOLOS to students and affective indicators relating to SOLOs were collected.

The sample for this study consisted of sophomore, junior and senior-level students pursuing a minor in equine science who were enrolled in an equine production class. A convenience sample was used to obtain the participants for this study. Thirty-one students enrolled in the class were in the control group and 27 students enrolled in a different section of the class were in the treatment group. Both semester-long 15-week classes consisted of a weekly lab lasting 1 hour and 50 minutes and 2 weekly lecture classes lasting 50 minutes each. The research site was the equine production lab located in a Center at the University of Arkansas

The difference between the treatment and control group course experiences was the use of SOLOs for the selected content. The sequence and topics were the same for both groups. There topics were selected for the SOLOs and were provided for the experimental group one week before each class. For the SOLO presentations, pre-tests and post-tests were utilized. Pre-tests were administered in advance of the teaching session. An anonymous student evaluation form pertaining to the SOLO unit was given to the students at the completion of the SOLO topics. These evaluation forms asked students to evaluate the usefulness of the SOLO on a 1–5 Likert scale (1=strongly disagree; 5=strongly agree). Affective indicators of student engagement were observed and collected by the researcher for each lab where SOLOs were used. Topics taught for both the SOLO and non-SOLO groups were: colostrum, foal IgG, and emergency horse care.

Effectiveness of SOLOs

Students' retention and mastery of the subject matter was assessed by unit exams. Students in the treatment group were asked to rate the value of the SOLOs at the end of the SOLO units. A series of statements was developed to determine the usefulness that students placed on the three SOLO units. These statements were rated on a 1–5 Likert scale. Responses were collected anonymously.

Affective indicators of the treatment group were collected unobtrusively by the researcher after each of the three SOLO units. Exam scores on three units taught with and without SOLOs were compared using Analysis of Covariance (ANCOVA), with official high school grade point average as the covariate. Cohen's f (Cohen, 1988) was used as the measure of effect size. Descriptive statistics were also used to analyze the data.

Results and Discussion

The study sample consisted of a control group of 31 students enrolled in a horse production class and a treatment group of 27 students enrolled in a horse production class. Both were 15-week courses, which consisted of a weekly lab lasting 1 hour and 50 minutes and 2 weekly lecture classes lasting 50 minutes each.

An alpha level of 0.05 was used to determine the statistical significance of the ANCOVA tests for the three unit exams. The non-SOLO group had a higher grade point average and a higher percentage of seniors, which may have given the non-SOLO group a slight advantage in exam performance. Despite this fact, on each of the three unit exams, the SOLO group outperformed the non-SOLO group. The observed differences between the two groups were statistically significant (Table 1). The obtained Cohen's f values ranged from 0.29 to 0.62, indicating a moderate to large effect for SOLOs on exam performance (Cohen, 1988).

Table 1. ANCOVA Tests of IgG, Colostrum, and Emergency Care Unit Exams, Non-SOLO vs. SOLO

Variable	LS Means	df	Type III SS	F	p	Cohen's f
IgG		1	29.54	4.34	0.04	0.29
Non-SOLO	11.56					
SOLO	10.01					
Colostrum		1	36.63	6.53	0.01	0.37
Non-SOLO	11.20					
SOLO	12.00					
Emergency Care		1	103.30	18.62	<0.001	0.62
Non-SOLO	10.92					
SOLO	13.85					

Usefulness Perceived by Students

Students were asked to anonymously rate statements pertaining to SOLOs (Table 3). At the end of each of the three SOLO labs, seven statements were rated on a 1–5 Likert scale (1=strongly disagree; 5=strongly agree). The range in means for all statements regardless of SOLO unit was between 3.44 and 4.62. The averages of the means for all of the statements pertaining to the three SOLO units were: colostrum SOLO m=3.85, IgG SOLO m=4.31, and emergency horse care SOLO m=4.27. The colostrum SOLO was the first taught. After students had the opportunity to participate in a SOLO-taught class, the mean overall statement scores of the remaining two SOLO increased, indicating that students might need additional orientation to this new support system (SOLO) prior to introducing.

Table 3: Average Student Ratings for all SOLO Units

	Overall Rating			
	Colostrum	IgG	Em Care	Total
Statement	**n = 27**	**n = 17**	**n = 21**	**N=65**
SOLOs made it easy for me to prepare for exams	3.88	4.35	4.00	4.05
SOLOs would be helpful in other courses	3.92	4.30	3.71	3.95
SOLOs helpful in determining what I am expected to learn	3.92	4.06	4.10	4.02
I found the activities and scenarios helpful	3.72	3.94	4.76	4.13
The self-quiz was beneficial	4.04	4.53	4.62	4.37
Handouts were pertinent	4.04	4.47	4.24	4.22
I liked the SOLO	3.44	4.53	4.48	4.08
7 statement average based on SOLO Unit	**3.85**	**4.31**	**4.27**	**4.11**

Note: Ratings on 1 – 5 Likert Scale (1 = strongly disagree; 5 = strongly agree)

When students were asked to rate the statement "SOLOs make it easy for me to prepare for exams," 52% of students strongly agreed with this statement for the colostrum SOLO unit, 52.4% of students strongly agreed with this statement for the emergency horse care SOLO unit, and over 70% either agreed or strongly agreed with this statement for the IgG SOLO unit. Fewer than 10% of the students felt that the SOLO was not helpful in preparing for exams. In examining the total average score for all three SOLO units, 67% of students who responded to the evaluations either strongly agreed or agreed that SOLOs were beneficial when preparing for exams (Table 2).

Table 2. Frequency and Percentages of Student Ratings for Three SOLO Unit Evaluations of the Statement "SOLOs make it Easy for me to Prepare for Exams"

		Strongly Disagree		Disagree		Neutral		Agree		Strongly Agree	
Unit	N	n	%	n	%	n	%	n	%	N	%
Colostrum	27	2	7%	2	7%	5	19/%	3	11%	15	56%
IgG	17	0	0%	0	0%	5	29.4%	6	35.3%	6	35.3%
Em Care	21	1	4.8%	1	4.8%	4	19.1%	4	19.1%	11	52.4%
Total	64	3	4.7%	3	4.7%	14	23.4%	13	20.3%	30	46.9%

Note: Number of student ratings reflective of participant attendance at session;
1 – 5 Likert Scale (1 = strongly disagree; 5 = strongly agree)

Affective Indicators

For each of three topics taught using SOLOs, affective indicators of behavior were collected. For the SOLO supported group, students were provided links to journal articles through e-mail along with a message indicating that they would not be tested over the provided journal articles. As part of the SOLO evaluation, students were asked to anonymously answer the true/false statement "I read the journal articles provided, although they weren't required". Students (31%) indicated they had read the articles, supporting that some students had additional interest and motivation to learn more about the topic beyond the course requirements.

Additional affective indicators were collected after the emergency horse care content. To assess student affective behavior of the Emergency Horse Care SOLO class, optional practice time was offered. An announcement was made that, although the lab was over, students could stay to practice hands-on skills learned during the emergency horse care lab if they chose. SOLO supported students, volunteered to stay with 73% opting to practice hands on skill sets, staying after the end of the scheduled lab.

Summary

Four types of data were obtained in an effort to determine if utilizing SOLOs: (a) made any difference on unit exam performance for three unit exams: colostrum, IgG, and emergency horse care; (b) influenced the retention of material as measured by unit exam scores; (c) were perceived as useful by students when preparing for exams and determining what they were expected to learn; and (d) produced evidence of voluntary affective indicators by students.

On all three unit exams, the SOLO group significantly outperformed the non-SOLO group. These results indicate that use of SOLOs is an effective method of increasing student learning and academic performance in an equine science course. When students anonymously responded to statements concerning SOLOs, their perceptions were overwhelmingly positive, underscoring the fact that the students found the SOLOs useful in preparing for exams and a useful guide for what should be learned.

This study provided evidence that the use of the SOLO significantly increased student achievement on three equine production unit exams. The SOLO has the potential to increase student retention of information taught in equine science as well as other courses of study. Being clear about objectives and providing a roadmap showing students how to master these objectives are hallmarks of the SOLO and are an important for both students and faculty. An approach to instruction built around the SOLO offers a strategy that would meet the needs of both faculty and students in achieving their common goal of student success.

Stakeholders in higher education have been increasingly demanding improvement in the quality of education (Ulewicz, 2017; National Survey of Student Engagement, 2013). Concerned faculty members should be aware of factors that affect student success: external factors over which they have no control, characteristics of today's students, and finally the role faculty members can play to positively affect the education outcomes of students. Capitalizing on student abilities and offering students an opportunity to learn in an environment that motivates and engages them should be the goal of all faculty members. Faculty members must seek ways to increase their ability to assist students to learn more efficiently. The SOLO is a learner-centered approach to teaching that has been shown to have a positive influence on student motivation to learn and to help them to facilitate learning (Emery and Kalscheur, 2000). The SOLO has broad implications for higher education in supporting faculty and students.

Literature Cited

Archibeque-Engle, S.L. and G. Gloeckner. 2016. Comprehensive study of undergraduate student success at a land grant university, college of agricultural sciences, 1990-2014. North American Colleges and Teachers of Agriculture 60(4): 432-440. https://0-search-proquest-com.library.uark.edu/docview/1850644636?pq-origsite=summon.

Bain, K. 2011. What the best college teachers do. Harvard University Press.

Black, S. 2017. Enhance your reference skills by knowing the four phase of interest development. At the helm: Leading Transformation. http://www.ala.org/acrl/sites/ala.org.acrl/files/content/conferences/confsandpreconfs/2017/EnhanceYourReferenceSkills.pdf.

Cohen, J. 1988. Statistical power analysis for the behavioral sciences. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum.

Emery, L.J. and J.A. Kalscheur. 2000. Use of the student-oriented learning outline in research education. The American Journal of Occupational Therapy 54(3): 335-338.

Eison, J. 2010. Using active learning instructional strategies to create excitement and enhance learning. Department of Adult, Career and Higher Education. University of South Florida, Tampa, FL. www.cte.cornell.edu/documents/presentations/Active%20Learning%20-%20Creating%20Excitement%20in%20the%20Classroom%20-%20Handout.pdf.

Entwistle, N. 2003. Concepts and conceptual frameworks underpinning the ETL Project. Occasional Report 3. Edinburgh, Scotland: ETL Project.

Gallant, T. 2017. Academic integrity as a teaching and learning issue: From theory to practice. Theory Into Practice 56(2): 88-94. DOI:10.1080/00405841.2017.1308173.

Gallant, T. 2008. A new approach to academic integrity: The teaching and learning strategy. ASHE Higher Education Report 33(5): 87-103.

Greene, J.P. and G. Forster. 2003. Public high school graduation and college readiness rates in the United States. Education Working Paper, Educational Policy Research, Manhattan Institute for Policy Research, New York, N. Y. http://www3.northern.edu/rc/pages/Reading_Clinic/highschool_graduation.pdf.

Hammons, J.O. and S. Jaggard. 1984. A self-instructional guide to writing a student-oriented learning outline. Fayetteville, AR: University of Arkansas Higher Education Program.

Hart Research Associates. 2015. Falling short? College learning and career success. Washington, DC: Association of American Colleges and Universities. https://0-search-proquest-com.library.uark.edu/docview/1791668756?pq-origsite=summon.

Hu, S. and G.D. Kuh. 2003. Maximizing what students get out of college: Testing a learning productivity model. Journal of College Student Development 44(2): 185-203. DOI:10.1353/csd.2003.0016.

Hyndman, S.M. 1995. Using student oriented learning outlines in the noncommissioned officer academy. EdD Dissertation. University of Arkansas. Retrieved from ProQuest Dissertations and Theses.

Johnson, K.V. 2016. Improving adjunct nursing instructors' knowledge of student assessment in clinical courses. Nurse Educator 41(2): 108-110.

Joyner, S and C. Molina. 2012. Class time and student learning. Southwest Education Development Laboratory. http://www.sedl.org/txcc/resources/briefs/number6/.

Mortenson, T.G. 2011. Time use of full-time college students on weekdays ages 18-24, 2003-2009. Post Secondary Education Opportunity 223: 1-16. http://www.postsecondary.org/last12/223_111pg1_16.pdf.

National Center for Public Policy and Higher Education. 2010. Beyond the rhetoric: Improving college readiness through coherent state policy. http://www.highereducation.org/reports/college_readiness/CollegeReadiness.pdf.

National Survey of Student Engagement. 2013. Promoting student learning and institutional improvement: Lessons from NSSE, Bloomington, IN: Indiana University Center for Postsecondary Research and Planning. http:// nsse.indiana.edu/NSSE_2012_Results/pdf/NSSE_2012_Annual_Results.pdf.

O'Keeffe, P. 2013. A sense of belonging: Improving student retention. College Student Journal 47(4): 605-613.

Porter, C.B. 1980. The effectiveness of student oriented learning outlines in a community college introductory sociology class. EdD Dissertation, University of Arkansas. ProQuest Dissertations and Theses.

Preas, J.E. 1982. The effectiveness of student oriented learning outlines in a community college introduction to speech communication course. EdD Dissertation. University of Arkansas. Retrieved from ProQuest Dissertations and Theses.

Robinson, J.L. 1983. The effectiveness of student oriented learning outlines in a community college second semester freshman composition course. PhD Dissertation, University of Arkansas. Retrieved from ProQuest Dissertations and Theses.

Ulewicz, R. 2017. The role of stakeholders in quality assurance in higher education. Human Resources Management and Ergonomics 11. https://www.researchgate.net/profile/Robert_Ulewicz/publication/317301877_THE_ROLE_OF_STAKEHOLDERS_IN_QUALITY_ASSURANCE_IN_HIGHER_EDUCATION/links/5930f11445851553b6810656/THE-ROLE-OF-STAKEHOLDERS-IN-QUALITY-ASSURANCE-IN-HIGHER-EDUCATION.pdf

VanArsdale, S.K. and J.O. Hammons. 1998. Student oriented learning outlines: A valuable supplement to traditional instruction. Journal of Continuing Education 29(1): 22-26.

Van Horn, D.A. 1989. A study of the effectiveness of student oriented learning outlines (SOLO) in a community college business communication course. EdD Dissertation. University of Arkansas. Retrieved from ProQuest Dissertations and Theses.

Yilmaz, E., M. Sahin and M. Turgut. 2017. Variables affecting student motivation based on academic publications. Journal of Education and Practice 8(12). https://files.eric.ed.gov.