Plant diversity lab answers

The material I expect you to know from each lab that will be evaluated in the Final Test is as follows: Lab 6 - Diversity of Gut Microflora 1) Definitions: fermentation, foregut and hind gut fermenters, mutualism. 2) Compare and contrast foregut vs. hindgut fermenters; that can be the best and why. 3) The correct order of the digestive tract of the cone and termite and their microflora multimes (diversity of microorganisms and their role, as the fermenters are in each case). 4) Know the purpose and procedure of gram staining, and how to interpret results. 5) Know what is unique about Gram+ and Gram bacteria that make them stain different colors. 6) Be able to distinguish between bacteria and protozoa and recognize this organisms under the microscope 7) Forms of Bacteria. 8) Don't forget the questions about the last part of the film the evolutionary arms race. Lab 7 - Patterns of Plant Diversity and Greenhouses (App. F) 1) Definitions: adaptation, convergent evolution, co-evolution, stomata, esporophyte, gametophyte, shifting of generation life cycle. 2) Differences between the 4 groups of plants (the information found in the table on my website) 3) The development of terrestrial plants and adaptations developed with each group (see Fig. 1 in your lab manual). 4) Make sure you know the general plant life cycle and you identify haploid and diploid generations. 5) From the greenhouse: in general, you need to know the information that you fill out the worksheet, limit the factors in each ecosystem that is represented there (desert and rainforest), groups of plants in each ecosystem, adaptations of plants living in these environments, carnivorous plants (why are they carnivorous?). 6) Be familiar with answers to the questions you answered from the videos. Lab 8 – Pollination Biology 1) Identify and know flower parts. 2) Know and understand what double fertilization is. 3) Characteristics of flowers that may allow you to determine their pollinators (pollination syndrome). 4) Distinguish between pollination (self and outcross) and fertilization. 5) Know how plants do to attract the right pollinators 6) Compare and contrast Moncot vs Dicot. Lab 9 – Patterns of animal diversity 1) Definitions: Protostomes, deutorotomer, cephalization, monoecious, dioecious, the main characteristics of the four Phyla studied in this lab. 2) Be able to identify from a dissection different parts of octopus, earthworm, starfish, nejonö rule and tell how these parts are used by the organism (pay special attention to the unique properties of each organism). 4) Be able to compare and contrast feeding, method of movement and skeletal support of the animals we examined in lab Thank you for interesting in Services. We are a nonprofit group that runs this site to share documents. We need your help to maintain this site. To keep our site running, we need your help to cover our server cost (about $400/m), a small donation will help us a lot. Please help us share our service with your friends. Thank you for your participation! 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Francis*Department of Ecology and Evolutionary Biology , University of Colorado at Boulder , Boulder, CO 80309Find articles by Brett MelbourneMarshall Sundberg, Surveillance EditorReceived 2014 Mar 25; Revised 2014 Jun 7; Adopted 2014 Jun 8.Copyright © 2014 J.M. Basey et al. CBE—Bioscience Education © 2014 American Society for Cell Biology. This article is distributed by The American Society for Cell Biology under license from the author(s). It is available to the public under a Attribution–Noncommercial-Share Alike 3.0 Unported Creative Commons License (. ASCB® and The American Society for Cell Biology® are registered trademarks of The American Society of Cell Biology.We compared the learning cycle and expository format for teaching about plant biodiversity in a request-oriented university biology lab class (n=465). Both formats had preparatory lab activities, a hands-on lab, and a postlab with reflection and argumentation. The learning was assessed with a lab report, a practical quiz in the lab and a multiple choice exam in the simultaneous lecture. Attitudes towards biology and treatments were also assessed. We used linear mixed-effect models to determine the effects of lab style on lower order cognition (LO) and higher order cognition (HO) based on Bloom's taxonomy. In relation to expository treatment, the learning cycle treatment had a positive effect on HO and negative effect on LO included in lab reports; a positive effect on the transfer of from the lab report to the quiz; negative effects on LO quiz performance and on attitudes to the lab; and a higher degree of perceived difficulty. The learning cycle treatment had no impact on the transfer of HO from lab report to quiz or exam; quiz performance on HO issues; degree results on LO and HO issues; attitudes towards biology as a science. The importance of LO as a basis for HO in relation to these lab styles is addressed. Over the past decade, the recognition that disciplines of science have given rise to a new field of research called discipline-based education research (Singer et al., 2012). In undergraduate biology, biodiversity is a unique subject that is discipline-specific, of far-reaching importance due to the recent global loss of biodiversity (Thomas et al., 2004a ,b), and because biodiversity education is recognised as a worldwide priority in the UN Decade of Education for Sustainable Development (2005-2014; Lindemann-Matthies et al., 2009). Biodiversity refers to variations within and between all living organisms, including all ecosystems (terrestrial, marine, freshwater, etc.), and within and between species (Lindemann-Matthies and Bose, 2008). At some major universities in the United States, such as the University of Colorado at Boulder, biodiversity is being explored in the first year, introductory biology. Such classes often have 1000+ students divided into a lecture/recitation led by a professor and a lab taught by a phD teaching assistant (GTA). The lecture/ recitation is typically dominated by a lecture and discussions intended to reinforce content forestation; while, laboratories provide a practical experience of the diversity of living organisms through a combination of dissecting or analyzing living or preserved specimens, cultivation, or microscopically analyzing representative signs or adaptations. Student observations form the basis for a broad integrated reasoning that, most importantly, concerns the overall umbrellas of evolution and sustainability. Of key importance is that students develop integrated reasoning in the context of understanding the role of evolution in creating biodiversity, understanding how adaptations are crucial to ecosystem dynamics and how and why there is a balance in ecosystems that can be disrupted. Through this evolutionary framework, students can analyze ecosystems to understand why they have difficulty managing environmental changes. Currently in the United States, mainstream undergraduate biodiversity labs are often called marches through the fyla, as they are mostly nonexperimental, teacher-centric endeavors that emphasize declarative knowledge (see Harris-Haller, 2008; Morgan and Carter, 2008 ; Vodopich and Moore, 2008 ; Addy and Longair, 2009 ; and Fisher, Fisher,). Such lab patterns may fall short of higher order (HO) learning goals in biodiversity based on Bloom's taxonomy (analysis and synthesis) and do not follow recent recommendations in science, technology, engineering and mathematics (STEM) education to transform undergraduate science classes from pedagogy that emphasizes lower order (LO; knowledge and understanding) to pedagogy that emphasizes scientific reasoning, HO, and science-process skills (National Research Council, 2003; National Science Teacher Association, 2007 ; American Association for the Advancement of Science, 2010 ; National Academy of Sciences, 2010). Why do common biodiversity labs take on a march through phyla strategy and emphasize declarative knowledge? Basey et al. (2014) argued that the transition from an emphasis on declarative knowledge to evolution-based HO learning in biodiversity laboratories is difficult to successfully achieve due to the potential for cognitive overload due to three interlocking factors: the high quantity and novelty of required basic declarative knowledge, the extensive interactivity of concepts and the theoretical nature of evolution. Thus, innovative patterns of biodiversity laboratories that emphasize evolution-based higher order learning and testing of these patterns are much needed. The three-phase learning cycle is a well-supported pedagogy that improves student reasoning (Lawson, 2001) and is potentially a good practical model for this shift in learning goals. The three-phase learning cycle begins with exploration through practical activities aimed at engaging students and getting them to use inductive reasoning to derive explanatory hypotheses; this is followed with a teacher-centered, concept-introduction phase; and the cycle concludes with a concept-application phase in which students apply what they have learned using varying formats (Lawson, 2001). Most research examining different formats of the learning cycle has focused on the K-12 level, comparing a hands-on, learning cycle format (Balci et al., 2006; Dogru-Atay and Tekkaya, 2008 ; Yalcin and Bayrakceken, 2010 ; Yilmaz et al., 2011 ; Sadi and Cakiroglu, 2012). Research on the learning cycle in undergraduate college biology classes involving both lab and lecture is not as common. In an introductory biology lab/lecture for non-science majors, Lawson and Johnson (2002) showed that students' performance was greater in a semester-long three-phase learning cycle format compared to a traditional class design; however, lo and HO were not separately assessed. In the same study (published separately), Johnson and Lawson (1998) showed that although performance was significantly greater in learning cycle therapy, reasoning ability was the only covariance that explained a significant variance in performance points for both Styles. In a semester-long, community college cell biology course, Jensen and Lawson (2011) found that students in a three-phase learning cycle treatment outperformed students in a traditional class setting at HO, but no significant differences were seen for LO. One limitation of learning cycle studies is that learning cycle classes were designed to address learning goals, while the traditional style used the method that already existed and may not have been equally optimized to address learning goals. Traditional practical classes are a subset of a larger group of lab patterns called expository (Domin, 1999), where the teacher provides explicit information at the beginning and students verify by following teacher-derived procedures for a hands-on lab (Domin, 1999). The expository format can range from a traditional style usually associated with a cookbook lab format focusing primarily on LO (Jackman et al., 1987; Anders o.a., 2003 ; Luckie et al., 2004), to a request-oriented style emphasizing both LO and HO (Hohenshell and Hand, 2006 ; Basey and Francis, 2011). In introductory college chemistry, Domin (2007) found that the growth in student HO and science reasoning occurred at different times for an expository versus a problem-based lab (another lab style to emphasize HO). In the problem-based lab, reasoning and HO growth occurred during the lab process; while, in the expository lab, it occurred after the lab during report write-up, which included reflection, argumentation, and induction (Domin, 2007). Domin (2007) found that learning outcomes were similar between the two formats when each treatment had a prelab assignment, practical lab manipulation, and a postlab assignment that included reflection and argumentation; and argued that research comparing learning from expository versus other styles was not valid without all three components. The purpose of this study was to compare students' learning outcomes that are the result of two styles of biodiversity labs at the undergraduate college level for science majors: 1) the three-phase learning cycle with a problem-based application phase; and 2) an improved expository style with back-laden possibilities for reflection, argumentation, and induction. Both lab styles had a 3-wk preparatory lab experience, a hands-on focal lab experience, and a postlab write-up. In a concomitant study, Basey et al. (2014) that both lab styles examined in this study significantly improved students' learning of lecture-specific material at both lo-declarative skill level and evolution-based HO integration level with an improvement margin ranging from 6.3 to 11%. Each lab was embedded in a year-long investigation-oriented lab curriculum, where students had multiple avenues for exploratory investigation using multiple formats, including a full investigation, project lab experience. The study was conducted at the University of Colorado at Boulder in the spring of 2011 general biology lab (GBLII). GBLII was part of the year-long introductory sequence for science majors and was conducted simultaneously with a lecture covering similar content and topics, but it was also an independent, one-credit class that could be taken separately from the lecture. Overall, GBLII had 864 students, 60% of whom were freshmen, 30% were sophomores, 5% were juniors, and 5% were seniors. Each class had up to 18 students and was taught by a GTA (n = 24). The lab curriculum was a two-semester sequence that most students took in order (i.e. lab 1 and then lab 2). During the first semester, the students were introduced to science with two explicit, experimental laboratories and then practiced the request in a series of experimental laboratories that progressed in level/number of open components and culminated in an open, research-based, student project lab. During the second semester, the students continued with research-oriented experimental labs. Mixed with experimental laboratories were several nonexperimental practical biodiversity labs where students made firsthand observations of organisms through cultivation, microscopic analyses and dissections. Students had to expand their observations to derive the associated strife and explain the evidence from the lab and reasoning that leads to strife. During such laboratories, GTAs used mixed models of guidance with some didactic and some constructivist pedagogy. The facility's biodiversity labs were divided into two treatments: expository and three-phase learning cycle. Progressing alphabetically, gtA was randomly assigned to teach in one of the two treatments until 12 GTAs were assigned a single treatment. The rest of the GTA was assigned the second reading. To taught 12 GTAs in each treatment. On the first day of the class (week 1), relevant components of the study were explained to students, and all students were given the choice of whether or not to participate. Approximately 78% of students chose to participate. Participating Students Filled Out On-Line Colorado Learning Attitudes about Science Survey (CLASS; Semsar et al., 2011). Selection bias by participating versus non-participating students was not measured. In Week 2, students began preparatory lab activities that lasted 3 wk. In the preparatory lab activities students cultivated and grew C-Fern (Ceratopteris richardii) and examined its life cycle. In Week 5, students worked at a 2-h, 50-min, hands-on, plant biodiversity lab. In week 6, the students took a practical assessment at the beginning of the lab. In week 11, the students took a multiple choice assessment in the accompanying lecture. In Week 15, the students completed an attitude examination in the lab and completed the CLASS once again. Both preparatory lab treatments were so that students allocated about the same amount of time. Instead of lecturing during the preparatory lab activities, gta gave a handout and interacted with students in small groups. A comparison of the preparatory lab handout for each treatment is in Table 1. In the focal lab after the preparatory lab activities, the expository treatment class began with a lecture/discussion on plant life cycles in general that highlights similarities and differences, as well as adaptations for dry habitats. For the learning cycle, instead of hearing an introductory lecture by GTA, students began to rate by using their observations from the preparatory lab activities to construct a diagram of a life cycle of the mystery organism. After the introduction, students in both treatments were provided with handouts, which are compared in Table 2.Comparison of the preparatory lab activity handouts given to students in expository treatment versus 3-phase learning cycle treatmentExpositoryLearning cycle learning goals, including a list of terms. Learning goals generalized against science reasoning. A paragraph or two explaining the terminology, structures and purposes of observations and techniques to follow that day. An initial overview of the total prelab, which informed students that the purpose of the prelab was to act as scientists doing discovery science and to use observations to figure out and document important functions of a mystery organism. Step-by-step instructions with a diagram that describes the techniques of a hands-on procedure that day. Step-by-step instructions with a diagram that describes the techniques of a hands-on procedure that day. An explicit statement describing which observations should have been made and how they should be documented in the lab report. Space in handout for charts and notes. For example: Use a composite microscope to examine the sprouting spores below the image. Draw a sprouting spore and label spore rock, rhizoids and develop gametophyte. Students chose which observations to document and how to document them. Components of the fokalla balouts given to students in the expository treatment versus the learning cycle treatmentCategory expositoryApprentice cycleThe similaritiesLearning goalsLearning goalsLearn with specific information about each division of studied plants. Specific information on each division of studied plants. Handout differencesStep-by-step procedures and techniques for practical observations. An introductory sentence or two describing organisms in the division and techniques and specimens that were available for students to use for observations. An explicit statement that describes visualization with required labels. For example: Look at the living specimen of the moss under dissecting microscopes. Draw a gametophyte with an attached and mark the capsule at the tip of the fundamental issues related to the observations. Additional HO integrative reasoning matters. For example: Choose a theme and utilize specific evidence from examples in this lab to defend the hypothesis—Life originates in aquatic environments and then radiates to terrestrial habitats. Write-upA description of the required lab report: The document will consist of text, images, and images integrated with diagrams. A description of the necessary lab report: You will individually create a text document including drawings/photos that can educate a person about plant life cycles and provide a test of both of the following hypotheses: 1) life originates in aquatic environments and then radiated to terrestrial habitats, and 2) evolution by natural selection with adaptive radiation is an overall theoretical framework explaining the current diversity of living organisms. Numbered directions describing questions to be answered and images with labels followed the statement. During the first semester of the two semester lab sequence, GTAs met weekly for 2 h to prepare for the investigation-oriented experimental laboratories. During the first 7 wk, GTAs were subjected to several different lab styles and coached to use more of a constructivist approach each week, culminating in a full constructivist approach during the student lab project. During the second semester, the week before they taught the prelabs and the focal lab, gtas was provided with a practical workshop covering how to teach in each treatment. GTA teaching style in each treatment was verified with classroom observations. During the first 2 wk preparatory lab activities, J.M.B. and A.P.M. designed and modified a simple quantified checklist (Supplemental Material). To ensure observer consistency, the two researchers conducted several observation sessions together to calibrate the checklist, and throughout the week in the focal lab they continuously compared notes to ensure consistency. The checklist had three major categories: lab format, content teaching, and teacher interactions for teachers– Each category was on average for a treatment consistency score on a 3-point scale. GTAs that scored over a 2 for the treatment they taught were retained in the study, while, GTAs that did during a 2 were removed from the study. Of the 24 participating GTA, 3 gta were removed based on these criteria. Two additional GTAs were removed due to assessment issues. The overall assessment was made by a formative assessment (a student lab report), a formative/summative assessment (a practical quiz in the lab the week after the facility biodiversity lab), and a summative multiple choice exam in the concurrent lecture 6 wk after the facility biodiversity lab. As a large proportion of students took and lecture at the same time and the plant's biodiversity was a In the lecture, the plant biodiversity lab and practical quiz were timed so that they occurred before any coverage of the plant's biodiversity in the simultaneous lecture. Students in both treatments produced a postlab write-up (lab report) and submitted it this week after the facility's biodiversity lab. Because the learning cycle lab reports were open, the contents of each lab report were quantified by both treatments and categorized with a comprehensive checklist that included all the content that a student could have included in their lab report (Figure 1). The checklist was divided into knowledge and understanding (LO) and analysis and synthesis (HO) using the Blooming Biology Tool (Crowe et al., 2008). A point was assigned for each properly used content category in the lab report that was on the checklist. The final LO and HO scores for each lab report were the total number of correctly used content categories (1 point per box). We also scored lab reports that are based only on subset of content included as related directly to the quiz (shaded boxes in Figure 1). Because grading was first improved with practice and then stabilized, grading consistency was checked after assessment of the first 150 lab reports. Eighteen previously assessed lab reports were selected at random and reclassified. A paired t-test indicated that the knowledge/understanding score was statistically significantly higher in the regrade ($t = −3.19$, $df = 17$, $P_{two-tailed} = 0.005$) and the analysis/synthesis score was not significantly different ($t = 0.61$, $df = 17$, $P_{two-tail} = 0.55$). The first 150 lab reports were revalued to ensure that lab reports were kept to the same standard throughout the assessment process. The practical quiz given 1 wk after the facility biodiversity lab consisted of five stations. Three stations processed LO basic information used as building blocks for HO processing, and two stations dealt with HO integration built on the LO Foundation. Questions were categorized by level of learning utilizing the Blooming Biology Tool (Crowe et al., 2008). The three LO questions had two parts: visual identification (knowledge) and relating to visual identification to different aspects of the plant's life cycle (understanding). A visual issue had microscope slides next to a microscope, and students had to use a microscope to identify the specimen. The other two visual issues had a microscope image displayed on a computer screen. The two HO questions were a synthesis issue and an analytical question (Crowe et al., 2008). For the analysis question, students were given a data table and asked if the data were consistent with evolution through natural selection and to explain their answers. For the synthesis issue, the students received specimens from one of the four plant divisions examined. In a multiple choice question, the pupils were asked which of the animal phyla was the equivalent in terms of adaptations to terrestrial life and to explain their answers. (Students had a lab exploring animal diversity before the diversity lab facility.) To discourage sharing answers from students, we used two paired versions of the quiz and randomly shared them between different treatments. Each quiz question answered a question about the second version of the quiz. Both versions of the quiz had the same analysis issue. A matched LO basic question (computer image) was excluded from the analysis because students' performance across treatments indicated the paired questions were different in severity. The remaining four questions—two LO and two HO—were not significantly different between versions (par 1: $P_{two-tailed} = 0.706$; par 2: $P_{two-tailed} = 0.186$; par 3: $P_{two-tailed} = 0.499$; par 4: $P_{two-tailed} = 0.260$; par 5: $P_{two-tailed} = 0.359$). Because learning cycle lab reports were open, students in learning cycle treatment were less likely than students in expository treatment to address material in the lab report that was directly related to the quiz. Thus, to compare relative transfer of learning from the lab report to the quiz, components of lab reports that directly related to quiz questions were tallied (see Figure 1). Relative transfer was calculated using the following equation: where Qscore = student quiz score (%), Bchecked = number of query boxes checked in the lab report checklist (shaded boxes in Figure 1), and Btotal = the total possible number of question boxes that could be checked in the lab report checklist (shaded boxes in Figure 1). (Note: lab report questions were different from quiz questions, so a relative comparison at best could only be done.) Positive scores indicated students demonstrated greater understanding of LO and/or HO on the quiz than on the lab report (transmission), while negative scores indicated students demonstrated less understanding of LO and HO on the quiz than on the lab report (transmission). Six weeks after the diversity lab facility, students in the lecture received a multiple choice exam. Ten multiple choice questions related to plant biodiversity were written on knowledge, understanding and analysis levels of Bloom's taxonomy according to Crowe et al. (2008) . The lecture professor (B.M.), who had no knowledge of the lab treatments, chose several exam questions from each level of learning to include on the exam (10 skills, 6 understanding, and 5 analysis). To verify that the multiple choice questions were correctly categorized into Bloom's levels, two independent experts examined the questions and categorized them independently into Bloom's levels. For each reviewer, a square weighted coat (Cohen, 1968) was estimated in relation to the independent classifications of J.M.B. 1: $K_{qw} = 0.863$, $SE = 0.035$; reviewer 2: $K_{qw} = 0.870$, $SE = 0.006$). CLASS uses a pre-post format and examines students' perceptions of biology and how they are affected by classroom teaching. The starting point is that attitudes and beliefs of experts in biology are different from beginners. Pedagogy that promotes expert-like attitudes and beliefs is sought. KLASSEN has been well validated and widely used (Barbera et al., 2008). We appreciated students' attitudes towards specific laboratory sessions with a validated survey (see Basey et al., 2008). In the survey, students were asked to rate the labs on a scale of 1-10. In addition to providing an overall lab grade, students were asked to rate each lab based on how easy they thought the lab was to master (ease of lab), level of excitement, time efficiency, and how much the lab helped with the lecture. We included these four actions in the survey, because previous research on lab style has indicated that these four parameters are important factors that influence students' attitudes toward different styles of biology labs (Basey et al., 2008; Basey and Francis, 2011). We used linear mixed-effect models to determine the effect of lab style (expository vs learning cycle) on response variables of LO and HO questions on lab reports, the facility diversity quiz in the lab (quiz), and the facility diversity multiple choice exam scans in lecture (exam and class grades). We treated lab style as a solid effect and GTA as a random effect. Because students' attitude assessments were anonymous, we could not use GTA as a random effect in models with their inclusion. Therefore, for models where we tried to determine how lab style influenced attitudes and how attitudes affect overall lab scores, we used linear regression. Where applicable, response variable points were arcsin square root—transformed to meet assumptions of normality and homogeneity of variance prior to analysis. Where needed, we standardized parameters that were on different scales (i.e. when lab report scores were included in lab style models). This was achieved by centralizing predictor variables to an average of zero and an SD of 0.5, placing continuous variables and binary variables on a common scale for direct comparison. All analyses were performed using the Lm4 package in the R Development Core Team (R) (2012) program. For model selection, we used an information-theoretic approach to evaluate support for competing candidate models (Burnham and Anderson, 2002) with the Akaike information criterion corrected for small sample sizes (AICc) to determine the most frugal model that best explained overall lab rating. We ranked models based on differences in AICc score (ΔAICc; full model-sample results are available in supplemental materials). affected by lab style. Specifically, the learning cycle format can be exposure treatment) had an independent, negative impact on the LO in the lab report (Table 3 and Figure 2). In contrast, the learning cycle format had a small positive effect on ho in the lab report in relation to the expository format (Table 3 and Figure 2). See Supplemental Materials for the results of the full analysis. Model-cut coefficient estimates for all variables found in models with strong support (≈AICc < 2) from linear mixed-effect models (teaching assistant treated as a random effect)aExplanatorian variable Coefficient EstimationSSeLower CIUpper CIRelativeDoes importance lab-style influence on lab reports produced by students? Lab report LOStyle-LC−0.0790.018−0.114−0.0441.00Lab report HOStyle-LC0.022b0.0090.0040.0401.00Is the transfer/retention of information from lab report to lo and HO quiz zest for the different lab styles? Lab report LOStyle-LC5.699b2.1401.5059.8931.00Does the combination of classroom activities and the lab report affect the learning of students in the various treatments assessed by the quiz and exam? Quiz LOStyle-LC−0.091b0.029−0.146−0.0351.00LR-HO0.109b0.0260.0580.1601.00LR-LO0.118b0.0270.0650.1701.00Quiz HOStyle-LC0..022b0.025−0.0270.0700.34LR-HO0.091b0.0230.0460.1361.00LR-LO0.059b0.0240.0130.1051.00Exam LOStyle-LC−0.015b0.021−0.0560.0260.32LR-HO0.057b0.0200.0170.0961.00LR-LO0.045b0.0210.0050.0861.00Exam HOStyle-LC0.030b0.032−0.03 Results indicate that lab style did not influence the relative transfer of HO from the lab report to the quiz (i.e., the null received more support than the model including lab style [ΔAICc = 2.01]). However, the learning cycle format (relative to expository format) had a strong positive effect on the relative transfer of LO from the lab report to the quiz (i.e. the power size was very high; Table 3 and Figure 2). Models including lab style and both LO and HO lab scores received significantly more support over null models for explaining LO and HO quiz scores (ΔAICc = 63.56 and 29.63, respectively) and LO and HO exam points (ΔAICc = 15.69 and 10.41, respectively). However, there were differences in the relative influences of these variables on quiz and exam scores. For example, the learning cycle style had a negative effect on quiz LO scores in relation to the expository style, but did not affect HO quiz scores or any exam results (Table 3 and Figure 2). As you would expect, LO and HO lab report scores had positive effects on LO and HO exam and quiz scores. The only exception is that LO lab report scores did not have an effect on HO exam scores. Aside from this exception, LO and HO performances at lab reports were predictors for both LO and HO performance on quizzes and exams (Table 3). In order to assess whether the student groups in treatment was different in their against specific laboratories, we had students state their attitudes towards two control laboratories in addition to the facility biodiversity lab. We found no evidence that students' attitudes toward control laboratories differed between treatments. In this case, null (ΔAICc = 0.00) had better support from the data than the model including lab style (ΔAICc = 2.01). For the facility biodiversity lab where students were exposed to various treatments, the learning cycle of treatment seemed to have negative rather than positive effects on students' attitudes toward the lab. For example, relative to expository, the learning cycle format had a strong negative effect on the overall scores and ease of lab scores (i.e., they thought the learning cycle format was more difficult) but not on any other variables. Overall grades were positively impacted by low difficulty, high voltage, more help with the lecture part of the class, and high time efficiency (Table 4). Model-sectioned coefficient estimates for all variables appearing in models with strong support (ΔAICc < 2) from linear regression modelsExplanatorive variable Coefficient tax valueSELower CIUpper CIRelative importanceHow do different treatments affect students' attitudes? Overall lab ratingStyle-LC−0.4670.219−0.896−0.0381.00ExcitementStyle-LC−0.3560.214−0.7750.0630.59HelpStyle-LC−0.4280.242−0 90 20.0460.64TimeStyle-LC−0.2780.229−0.7270.1710.43EaseStyle-LC−0.4860.214−0.906−0.0661.00As attitude variables affect overall lab score? Overall lab ratingTime0.3990.0360.3280.4701.00Ease0.2250.0380.1500.3011.00Help0.1220.0330.0570.1881.00Excitement0.2390.0380.1660.3131.00The view of CLASS is that experts in biology have different beliefs than beginners and instructional techniques that encourage students to have more expert opinions are better. CLASS was given as a pre/post assessment. There was no support for an impact of learning cycle treatment (relative to expository treatment) on attitude changes in either the favorable (more like experts) or unfavorable (less as experts) direction (i.e. null models had ΔAICc scores < 2.00 and 95% confidence intervals (CI) for model-average coefficient estimates for lab style overlapped zero in both cases). In this study, we compared two practical plant biodiversity labs that were both designed to emphasize the same learning goals (LO and HO) for undergraduate college science majors. Most studies that have examined lab-like, hands-on learning in college have compared an outdated traditional style (i.e. what is currently in practice) with an alternative request-oriented design (Suits, 2004; Lord and Orkwiszewski, 2006 ; Pook, etc., 2007 ; Brickman et al., 2009). Furthermore, studies examining the learning cycle in university-level biology classes have compared pupils' learning with a traditional style that was not specifically designed learning objectives examined. In this study, the design does not favor either treatment. The gtas were randomly assigned to a treatment and removed from the assay if they did not properly conduct the treatment. For cognitive assessments where GTA identity was known, we weighed out the GTA effect in the statistical analysis. Thus, we were able to compare the effect of expository style and three-phase learning cycle style to meeting biodiversity learning goals associated with large initial lab classes with multiple sections taught by new GTAs.Since we couldn't find a verified plant biodiversity practical assessment for the desired learning goals in a lab setting, we developed the two cognitive assessments for this study (quiz and exam) , and the postassessment design for the cognitive assessments were appropriate to compare student learning resulting from the two treatments. The attitude assessments were both previously verified and well supported. Other research on the learning cycle has used a generalized measure of reasoning to assess reasoning gains (Johnson and Lawson, 1998 ; Lawson and Johnson, 2002 ; Brickman et al., 2009). Given that our ultimate goal was biodiversity education, we evaluated reasoning in the context of higher order reasoning about plant biodiversity content based on Bloom's taxonomy. The format of the lab report was an important difference between the treatments. The lab report for the expository format was explicitly prompted, thus focusing students on specific content related to learning goals. The lab report's call to the learning cycle format, on the other hand, was open and allowed students to incorporate a wider range of content information related to learning objectives. Theoretically, this difference is an important difference for students' learning. With the open lab reports, students had to construct their own meaning and create a document that contained important evidence to support strife. Thus, they initially needed to evaluate more of the information from the lab to determine what should be included in the lab report. However, students in expository style could focus on answering the specific questions from the report. Therefore, we expected that the transfer from the formative lab report would be greater for the learning cycle than for the expository style. The study raised two questions: 1) How does lab report content (quality and honesty) compare between treatments? 2) How does content included by students in the formative lab reports transfer to learning that is assessed with the summative quiz? Student lab reports were affected by lab style. Specifically, the open lab reports had less LO content and more HO reasoning than the prompted lab reports (Table 3 and Figure 2). Lab reports from the expository classrooms followed the format and of the teacher's prompts, while lab reports from learning cycle classrooms varied widely. Learning cycle reports were more likely to include full lifecycle diagrams for each fylum studied in the lab, while guided reports provided individual, tagged images to answer the prompt. While a lack of teachers provided guidelines like learning cycle students with the ability to include more comprehensive content, it also meant that students did not have organized and layered basic information to build on. Although lo was lower in the learning cycle as assessed by the quiz, there was no difference for HO between the two lab styles (Table 3 and Figure 2). Because the quiz tested a subset of the information that could be included in the lab report, we quantified items on the quiz that were specifically included in the lab report for each individual student and cross-referenced student quiz results specifically on these objects (relative transfer). For every fraction of the LO quiz content processed by a student on the lab report, the learning cycle student performed relatively better on the associated quiz question than did an expository student (Table 3 and Figure 2). This may have been the result of a learning cycle student in relation to an expository student understanding the importance of a LO object for inclusion in the open lab report, or alternatively, that in relation to the expository student, the learning cycle student opted not to include specific LO information in the lab report that he/she knew and understood. No differences were seen between the two styles of transfer/retention of HO from the lab report to the quiz (Table 3 and Figure 2). For the practical quiz, LO questions assessed a student's ability to: use microscopes to make observations, use observations to identify specimens and/or parts of specimens and understand material. The quiz was given in the lab before any coverage of plant biodiversity in lecture and thus assessed student learning primarily from the lab and report experience. Pupils in the learning cycle format did not perform as well on lo questions as students in the expository format (Table 3 and Figure 2). Logically, then, something about learning cycle formats does not prepare students as well as on LO basic information as expository format. There are two plausible explanations. The first is that the lack of guidance in the open lab report did not focus students on LO basic information related to desired learning goals. The second may depend on the design of the preparatory lab experience. For learning cycle treatment, the initial engagement phase is crucial to motivate students (Karplus, 1977). In the learning cycle format used here, the initial engagement phase may have failed in relation to expository. The commitment to the preparatory about tension associated with identifying a mystery organism. Theoretically, after acting as research biologists, making their observations, and derived their life cycle of the mystery organism, we expected extra involvement during the explicit instructional phase and a potential favorable change in their class score, but no such change was present. (Although it is also possible that since the overall year-long curriculum was filled with survey-oriented experiences that the impact of the single lab experience on CLASS was reduced.) Observations (not quantified) showed that while some students were excited to solve the mystery, many students were excited about the observations themselves. Further evidence stems from the results of the attitude assessment that indicated students do not differ in their grades of tension between lab styles, but they rated expository style as lighter than the learning cycle style. While students in the learning cycle treatment discovered, students in expository treatment were learning terminology associated with plant life cycles; and thus, students in expository treatment were further exposed to the new terminology associated with plant biodiversity. It is possible that with the high amount of new terminology, students needed a little more exposure to the conditions before HO integration than was delivered by this learning cycle module. Other research has shown that the learning cycle style is particularly important for generalized reasoning gains not necessarily associated with specifically content (Johnson and Lawson, 1998 ; Lawson and Johnson, 2002). Thus, one of our expectations for the learning cycle style was in relation to the expository style of ensuring students perform better on ho assessment questions about the quiz. No such result was seen. Logically, in order to integrate information on HO, students need to have a strong grasp of the basic LO information. Thus, if the learning cycle format did not provide lo foundation as well as expository format, although students may have received some HO reasoning practices with the learning cycle format in relation to the expository format (as seen with the positive relationship between HO and the learning cycle format in the lab report), but lo they may not have been able to show their reasoning gains on the quiz that required basic LO information to build on HO integration issues. The lecture test provided information about longer-term learning/retention, but was problematic by the students being subjected to teaching about plant biodiversity in lecture in addition to the lab experience. The lecture test was also a multiple choice format where students had to recognize the correct answer rather than generate the answer themselves. Both factors reduce the relative effect of the lab in relation to time from instruction and the quiz. The results showed no discernible long-term effects were present on exams for HO and LO due to differences in lab treatments. In this study, all attitude variables (time efficiency, excitement, simple lab, and lecture help) made up the best model for explaining student grades by the facility's biodiversity lab. The two explanatory variables with the greatest power sizes (time efficiency and voltage) did not produce any significant differences between the two lab styles. Basey et al. (2008) found excitement to be the most important of these four factors in determining student overall attitudes toward the lab. Basey and Francis (2011) showed that in a guided study (expository) versus a problem-based lab, students did not differ in their view of how exciting the lab was, but differed in the other three factors examined (simple lab, time efficiency and lecture help). The expository lab was considered by students to be less difficult. Basey and Francis (2011) concluded that lab style may not be a driving force that changes students' perception of lab tension scores, but that other factors such as the subject, personal relevance to students, and materials raised may be more important in changing the tension ratings. This information is in line with this claim. These findings lead to a complex interpretation and a dilemma about the style that was best for learning about plant biodiversity within a college-level, survey-oriented lab curriculum for science majors. While expository style produced better student learning of LO and better attitudes from students, it is possible that the open lab report and problem-based application phase of the learning cycle format produced better transmission of LO from the formative process (lab and lab report) to the summarized assessment (quiz). With the highly integrated and new basic information, a guided preparatory lab experience can be crucial to building the foundation on which HO can be built. Perhaps the best model could be a guided 3-wk prelab experience with C-fern, followed by the problem-based application phase with the open lab report format. Supplemental Material: The project was funded by the Integrating STEM (iSTEM) training initiative. Support for C.D.F. was provided by the University of Colorado Graduate School and the National Evolutionary Synthesis Center

(NSF EF-0905606). The manuscript preparation was independent of all funding bodies. Addy HD, Longair RW. Laboratory Manual for Biology 223, Organism Biology of Plants and Animals. Plymouth, MI: Hayden McNeil; 2009. [Google Scholar] American Association for the Advancement of Science. Vision and Change in Undergraduate Biology Education: A Call to Action. Washington, DC: 2010. [Google Scholar] Anders C, Berg R, Christina V, B, Bruno K, Lundberg S. S. from an open experiment? A comparison of attitudes to, and results of, an expository versus an open survey version of the same experiment. Int J Sci Educ. 2003;25:351–372. [Google Scholar] Balci S, Cakiroglu J, Tekkaya C. Engagement, exploration, explanation, extension and evaluation (5E) learning cycle and conceptual text change as learning tools. Biochem Mol Biol Educ. 2006;34:199–203. [PubMed] [Google Scholar] Barbera J, Perkins KK, Adams WK, Wieman CE. Modify and Validate Colorado Learning Attitudes about the Science Survey for Use in Chemistry. J Chem Educ. 2008;85:1435–1439. [Google Scholar] Basey JM, Francis CD. Design of research-oriented science lab: influences students' attitudes. Res Sci Tech Educ. 2011;29:241–256. [Google Scholar] Basey JM, Maines AP, Francis CD, Melbourne B, Wise SB, Safran RJ, Johnson PTJ. The effects of pre-lab learning activities, a post-lab written report, and content reduction on evolution-based learning in an undergraduate plant biodiversity lab. Evol Educ Outr. 2014;7:10. [Google Scholar] Basey JM, Sackett LS, Robinson NS. Optimal science lab design: effects of different components of lab design on students' attitudes to the lab. Int J Schol Learns. 2008;2:Article 15. [Google Scholar] Brickman P, Gormally C, Armstrong N. Effects of investigation are based on students' science literacy and trust. Int J Schol Learns. 2009;3:22. [Google Scholar] Burnham KP, Anderson DR. Model selection and inference: A practical information-theoretic approach. New York: Springer-Verlag; 2002. [Google Scholar] Cohen JN. Weighted coat: nominal scale contract provision for scaled disagreement or partial credit. Psychol Bull. 1968;70:213–222. [PubMed] [Google Scholar] Crowe A, Dirks C, Wenderoth MP. Biology in Bloom: Conduct Bloom's taxonomy to improve student learning in biology. CBE Life Sci Educ. 2008;7:368–381. [PMC free article] [PubMed] [Google Scholar] Dogru-Atay P, Tekkaya C. To promote students' learning in genetics with the learning cycle. J Exp Educ. 2008;76:259–280. [Google Scholar] Domin DS. A review of laboratory instruction styles. J Chem Educ. 1999;76:543–547. [Google Scholar] Domin DS. Students' perceptions of when concept development takes place during laboratory teaching. Chem Educ Res Pract. 2007;8:140–152. [Google Scholar] Gelman A. Scaling regression inputs by dividing by two standard deviations. State Med. 2008;27:2865-2873. [PubMed] [Google Scholar] Harris-Haller, T. Laboratory Manual for Biology 112. 4. ed., Plymouth, MI: Hayden McNeil; 2008. [Google Scholar]Hohenshell LM, Hand B. Writing-to-learn strategies in secondary school cell biology: a mixed method study. Int J Sci Educ. 2006;28:261–289. [Google Scholar] Jackman LE, Moellenberg WP, Brabson GD. Evaluation of three instruction methods for teaching general chemistry. J Chem Educ. Scholar] Jensen JL, Lawson A. Effects of collaborative group composition and inquiry instruction on reasoning gains and achievement in undergraduate biology. CBE Life Sci Educ. 2011;10:64–73. [PMC free article] [PubMed] [Google Scholar] Johnson MA, Lawson AE. What are the relative effects of reasoning ability and prior knowledge of biology achievement in expository and inquiry classes? J Res Sci Teach. 1998;35:89–103. [Google Scholar] Karplus R. Science education and development of reasoning. J Res Sci Teach. 1977;14:169–175. [Google Scholar] Lawson AE. Use the learning cycle to teach biology concepts and reasoning patterns. J Biol Educ. 2001;35:165–169. [Google Scholar] Lawson AE, Johnson M. Validity of Kolb learning styles and neo-Piagetian levels of development in college biology. Dubbhög Educ. 2002;27:79–90. [Google Scholar] Lindemann-Matthies P, Bose E. How many species are there? public understanding and awareness of biodiversity in Switzerland; Hum Ecol. 2008;36:731–742. [Google Scholar] Lindemann-Matthies P, Constantinou C, Junge X, Kohler K, Mayer J, Nagel U, Raper G, Schule D, Kadji-Beltran C. Integration of biodiversity education into primary education for primary school teachers: four comparative case studies from Europe. Environ Educ Res. 2009;15:17–37. [Google Scholar] Lord T, Orkwiszewski T. Going from didactic to survey-based teaching in a science laboratory. Am Biol Teach. 2006;68:342–346. [Google Scholar] Luckie DB, Malezewski JJ, Loznak SD, Krha M. Infusion of collaborative investigation throughout a biology curriculum increases students' learning: a four-year study of Law and Streams. Adv Phys Educ. 2004;287:199–209. [PubMed] [Google Scholar] Morgan JG, Carter MEB. Investigating biology, Laboratory Manual. 6th ed., Glenview, IL: Pearson Training; 2008. [Google Scholar]National Academy of Sciences. A New Biology for the 21st Century: Ensuring the United States leads the upcoming biology revolution. Washington DC: National Academies Press; 2010. [Google Scholar]National Research Council. BIO2010: Transforming undergraduate training for future research biologists. Washington DC: National Academies Press; 2003. [Google Scholar]National Science Teachers Association. The integral role of laboratories in science instruction. Arlington, VA: NSTA; 2007. [Google Scholar]Pook JR, Burke KA, Greenbowe TJ, Hand BM. Use Science Writing Heuristic in general chemistry laboratory to improve students' academic performance. J Chem Educ. 2007;84:1371–1379. [Google Scholar] R Development Core Team. R: A language and environment for statistical data processing. Vienna, Austria: R-Foundation for Statistical Data Processing; 2012. www.R-project.org. [Google Scholar]Sadi O, Cakiroglu J. Relationship of cognitive variables with students' human circulatory performance in traditional and learning cycle classrooms. Soc Behav 2012;46:399–403. [Google Scholar] Scully TA, Fisher RWW. Discovering biology in the lab, an introductory laboratory manual. New York: Norton; 2009. [Google Scholar]Semsar K, Knight JK, Birol G, Smith MK. Colorado Learning Attitudes on Science Survey (CLASS) for use in biology. CBE Life Sci Educ. 2011;10:268–278. [PMC free article] [PubMed] [Google Scholar] Singers SR, Nielsen NR, Schweingruber HA. Discipline-based education research: To understand and improve learning in basic science and technology education. Washington DC: National Academies Press; 2012. [Google Scholar]Suits J. Assess exploratory skills development in survey-based and traditional college science-laboratory courses. Skols sci Math. 2004;104:248–257. [Google Scholar] Thomas CD, et al. The risk of extinction from climate change. Nature. 2004a;427:145-148. [PubMed] [Google Scholar] Thomas JA, Telfer MG, Roy DB, Preston CD, Greenwood JJD, Asher J, Fox R, Clarke RT, Lawton JH. Comparative losses of British butterflies, birds and plants and the global extinction crisis. Science. 2004b;303:1879-1881. [PubMed] [Google Scholar] Vodopich D, Moore R. Biology Laboratory Manual accompanying Brooker Biology. New York: McGraw-Hill; 2008. [Google Scholar]Yalcin FA, Bayrakceken S. Effect of 5E learning model on pre-service science teacher achievement of acids-bases subject. Int Online J Educ Sci. 2010;2:508–531. [Google Scholar] Yilmaz D, Tekkaya C, Sungur S. The comparative effects of prediction/discussion-based learning cycle, conceptual change text and traditional instructions on students' understanding of genetics. Int J Sci Educ. 2011;33:607–628. [Google Scholar] Articles from CBE Life Sciences Education are provided here courtesy of the American Society for Cell Biology Biology

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