

Implementing a Single Holistic Rubric to Address Both Communication and Technical Criteria in a First Year Design-Build-Test-Communicate Class

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Introduction

In the following paper, we describe our initial experiences in replacing the detailed analytic rubrics used for assessment in our team-taught first-year engineering technical and communication course with a holistic rubric. We address the issues we identified with the analytic rubrics we had been using, the holistic rubric we developed to address these issues, and the preliminary understandings we've developed--through our own reflections and an informal online survey of our students--of the impact of this change on our teaching and our students' experiences in the course.

Rubrics are frequently used to convey assessment criteria to students; their use in post-secondary education has been shown to have positive effects on students' ability to plan and assess their own work and to reduce student anxiety and uncertainty about how grades are determined (Panadero & Jonsson, 2013), and these beneficial effects are compounded when students are given the opportunity to review and discuss the rubrics with instructors in advance of completing an assignment (Reddy & Andrade, 2010).

Our course: Introduction to Engineering

Our course, Introduction to Engineering, is a team-based, project-based engineering communication course that serves as both the introductory engineering course and the first-year writing course for incoming engineering students. Ours is only one of between 12-15 sections of the course regularly offered each semester, each with a different theme and focus--for example, our course is co-taught by faculty in the Naval Architecture and Marine Engineering (NAME) Department, and so our course projects are NAME-related. Our enrollment is capped at 60 students per course, and students meet twice weekly for lecture and once weekly in their 20-student discussion sections and labs.

Assessment of project deliverables in our course

Our students work on teams of four or five students to design, build, and test (DBT) underwater vehicles; the grades for these DBT projects are assigned by technical faculty and communication faculty together, based solely on the resulting oral and written design reports. These reports are assessed using rubrics, and in the past, we provided our students with separate analytic rubrics:

one focused on technical criteria, and one focused on communication criteria (See sample rubrics in Appendix A). Each rubric assigned a proportion of the available points for the assignment—different assignments are weighted differently between technical and communication—and the oral and written reports received “Technical” and “Communication” points that were summed to make the final score.

Faculty concerns about the analytic rubric approach

Ours was a straightforward system, and one that (in theory, at least) allowed us to provide students with a clear description of our separate expectations for their reports. However, it began to be clear to the faculty team that this rubric model had troubling limitations for our team-taught, open-ended-project-based course.

Students seemed to use the rubrics as checklists of required features

Judging by the reports we received, students used each rubric as a series of discrete checkboxes, instead of considering how the different parts of the assignment contributed to the whole—regardless of the order in which the content on the rubric was presented, and despite the number of times that we emphasized that the organization of reports should be based on how the audience would understand the material best, the majority of student reports seemed to follow the same order of topics in the rubric. Our experiences mirror the findings of Zytner et al. (2015), who found that students also tended to treat a rubric as a template to be filled in, even when some categories of the rubric were made optional to account for the effective reporting of different projects.

The analytic rubrics lacked flexibility

At times, the faculty felt restricted by the analytic rubrics’ lack of flexibility to accommodate and value the different approaches required by different design choices made in the open-ended DBT projects (e.g. some designs would require a much more detailed discussion of stability, while others would benefit from more images or a greater focus on consistent performance, but teams would fulfill the static requirements of the rubric instead of making effective rhetorical decisions based on the needs of their project and audience). We had created scenarios for the design projects that allowed for broader, more creative solutions, but the rubrics didn’t encourage or value that creativity.

Students were focused on points instead of learning

Analytic rubrics can lead students to focus more on their targeted score or grade and less on whether their product is an effective example of what they were expected to produce (Panadero & Jonsson, 2013). It’s not surprising that our students are focused on their grades or that they care about how their score on a particular assignment could have been higher; however, the

association of points with the specific categories on the analytic rubric (e.g., 5pts for including center of buoyancy and center of gravity calculations; 10pts for performance during the Q&A) seemed to lead students to focus too intently on the number of points earned for a specific category, rather than on the pedagogical goals those categories were intended to represent. Additionally, students' focus on the analytic rubrics could be undermining our learning goals for the course: starting with a pre-existing rubric can draw students away from fundamental understandings and toward discrete criteria that might not make sense to them yet: "Even very good rubrics that articulate sophisticated versions of expertise and scientific practice risk artificially demarking notions of quality and undermining students' scientific reasoning when set out in advance as a roadmap for reasoning" (Tang, Coffey, & Levin, 2015, p 674).

The rubrics didn't represent authentic audience responses

This was arguably the most significant limitation of the analytic rubrics: they didn't effectively represent for the students the way(s) in which design deliverables are evaluated in a non-academic context, and therefore writing in response to those rubrics wasn't providing the "authentic," real-world design project experience that is one of the goals of our course. A supervisor or potential client wouldn't decide how they felt about a design report by tallying up a series of points awarded for discrete categories, nor would they be likely to evaluate an oral progress report by considering the technical content separate from the way in which that content is delivered; audiences react and respond to written and oral communication much more holistically--even those audiences evaluating work using analytic rubrics have been found to score holistically, based on their overall impressions of the work (Rezaei & Lovorn, 2010)--and we wanted the expectations of our course to map more effectively onto this reality.

Our Alternative Holistic Rubric System

Our solution was to collaboratively develop a single holistic rubric (see Figure 1 below) that would be used for all grading of the major project deliverables (reports and presentations), as well as for the communication portion of all smaller individual and group assignments. (The technical grading for non-project-deliverable assignments is done by a student grader, and student graders aren't allowed to apply open-ended rubrics; therefore, for these assignments, the previous check-box rubric was still used.)

General Grading Rubric

(A+) 100.0% of points possible. Work earning this score is **ready to be passed on to a real client**. In every way, it meets audience needs. Major points are clear and well supported with evidence; technical content is correct. Document/presentation is formatted and organized to guide to major points. Clear and interesting visuals and prose contribute to professional-level quality.

(A/A-) 93.5% of points possible. Work earning this score is strong and all technical content is correct. If I were your supervisor on an internship, I'd suggest **minor changes before sending it on to a real client**. Those changes might include slight changes to prose, visuals, or formatting to increase clarity and readability. The suggestions are truly minor, and if the document were sent on without the requested changes, I wouldn't be too concerned. None of the errors are so large that they would affect our company's or your relationship with the client. See your document, as instructors will have made suggestions directly on the text.

(B+/B) 86.5% of points possible. Work earning this score is good. If I were your supervisor on an internship, I'd consider this a **strong draft but suggest changes before sending it on to a real client**. Either because of severity of a single issue (perhaps errors or missing evidence for technical content), or significant issues with prose, I would be concerned if this document went to a client without those changes made. See your document, as instructors will have made suggestions directly on the text.

(B-/C+) 80.0% of points possible. Work earning this score shows some promise, but it lacks much-needed polish and/or includes technical errors. If I were your supervisor on an internship, I would **require substantive revision to the majority of the document** before it could be passed on to a client. Though evidence of good ideas and/or solid engineering work is present, I am certain that a client would be too distracted by the many problems and/or technical errors to form a positive impression of you or our company. See your document, as instructors will have made suggestions directly on the text.

(C/C-) 73.5% of points possible. Work earning this score **requires significant revision before it can be passed on to a real client**. These changes include improvements in clarity and readability as well as in major content (perhaps content is missing, unclear, or wrong). I would panic if this document were sent directly to a client without significant revision, as I believe it could affect our company's relationship with the client. See your document, as instructors will have made suggestions directly on the text.

Lower scores than this are possible but uncommon (and usually the result of incomplete work).

Figure 1. Holistic grading rubric implemented in AY 2016-2017. The rubric combines both technical and communication expectations for assignments, including design reports, and uses the framing of appropriateness for distribution to clients as the justification for assigned scores.

This new rubric frames the impact of the student deliverables as the overall impression the deliverables would make on a supervisor who was evaluating the work before passing it along to a client. The holistic rubric provides five specific bins, each associated with a grade percentage from 100% to 73.5%, into which deliverables might fall, with each bin providing a description of the quality/condition of the work and the likely supervisor response to it. (The rubric indicates that scores lower than 73.5% are possible, but does not provide specific descriptions of the work associated with those lower scores, apart from a statement that such work would likely be largely incomplete.) In making this change, we anticipated several benefits:

The holistic rubric would encourage students to think rhetorically when documenting and describing their work

Rather than aiming to meet the discrete criteria listed on an analytic rubric, students would need to ask themselves how they could best communicate their specific design well, and what evidence they would need to gather to persuade a specific audience of their design's appropriateness given the scenario. Such an approach would likely transfer more accurately to their eventual professional lives.

The more flexible, holistic approach would allow us to value and reward innovation

Applying a holistic rubric would enable us to recognize both the innovative design decisions made by our students, as well as the rhetorical choices those students make in representing those design decisions in their written and oral reports, allowing us to reward students for taking risks in their designs and their documentation. Analytic rubrics can serve to incentivize just the opposite, by making the smart choice the “dreary and safe writing” that results from religiously following the rubric (Wiggins, 2009, pg. 31).

The new rubric would enable us to more appropriately reward high quality work overall

There wouldn't be certain numbers of points associated with specific aspects of a design or documentation that might not apply equally well to all projects (e.g., points associated with describing approaches to buoyancy when other design decisions make these approaches more or less significant) and we wouldn't run into the problem of our detailed analytic rubric failing to reward approaches that students might take to effectively represent and support particular design choices (for example, a token number of points associated with describing thruster placement may be appropriate for most teams, but how do we recognize the work of the one team who uses an innovative thruster configuration and justifies it brilliantly?)

In undertaking this revision to our grading approach, we recognized that there were several potential downsides in moving from an analytic rubric to one that evaluates based on the impression of the entire document: first and foremost, given that holistic rubrics are by definition less detailed, we would risk losing some of the existing transparency about how grades are assigned, and this might cause anxiety for our students who are frequently--and understandably--concerned more with the immediacy of the grade their work receives than the long-term pedagogical goals of the course. Additionally, we would risk losing the opportunities that detailed rubrics provide students to learn how to effectively plan and self-assess their work, which can be beneficial for students in the long term (Panadero & Jonsson, 2013).

Our revised rubric attempted to alleviate these drawbacks in two ways: 1) by continuing our practice of providing detailed written feedback on assignments (though now, those detailed comments would not tie that feedback to specific numbers of points gained towards the total score), and 2) by creating a brief but detailed document for each of the two major DBT projects that provides an explanation of what “client ready” (i.e., excellent) oral and written design

reports for the project would include (see sample description in Appendix B). These “client ready” descriptions provide specific examples of ways in which projects may excel, while allowing for the flexibility that was lacking from the analytic rubric.

Introduction and Implementation of the Holistic Rubric

Starting in Fall 2016, communication faculty used the holistic rubric for all grading of both individual and team assignments. As we’ve mentioned, the holistic rubric could not be implemented for the technical grading of those assignment assessed by a student grader, so for technical grading, the holistic rubric was used only on the final presentations and reports for the two DBT projects. The holistic rubric approach was explained to students during one of the first class meetings, and students were reminded to refer to the rubric and associated assignment materials while they were preparing their reports and other assignments.

Student Reactions to the Holistic Rubric System

In order to gauge our students’ impressions of the holistic rubric, we included a question on our end-of-semester exit survey asking students to comment briefly on how the holistic rubric system worked (or didn’t work) for them. (It should be noted that students received 2 extra credit points for completing the survey, and that while the survey was anonymous, it was completed through the university’s LMS, and therefore students may not have felt able to rely on the assurance of anonymity in making their responses.) Though we have approval from our institutional IRB to examine the impact of the new holistic rubric in our course, we are unable to draw sweeping conclusions from the survey responses. They represent only one semester’s implementation of the new rubric system, and the survey question was crafted only to elicit general feedback and overall reactions, with an eye towards not unduly lengthening an already-lengthy exit survey.

We carefully read through the responses and categorized elements as positive or negative. We identified a few themes in the responses, both positive and negative, and found that responses regarding the new rubric system were mixed: the majority of the students who responded had something positive to say about the holistic rubrics, but many of the comments mentioned both benefits and drawbacks to the holistic rubrics:

Drawback: Current system didn’t provide sufficient examples of “good” or “bad” deliverables
Many students mentioned a desire for more specific examples of the sorts of communication deliverables that faculty were (or weren’t, in the case of bad examples) looking to receive. Though the majority of the students requesting examples also spoke positively of the open-ended rubrics, they stated that it would be very useful to have access to “a few sample reports,” “some kind of example work (not perfect work),” or “different presentations to get an idea of the

various levels.” At different points in the semester, we already distribute and discuss sample deliverables (frequently with annotations), so it is unclear if the student feedback was requesting differently-presented example deliverables or simply more of them. It’s possible that the open-ended nature of the rubrics led students to want more examples of how the assignment objectives could be achieved, since the rubrics make clear that there are many possible effective approaches.

Benefit: Students appreciated that holistic rubrics provided opportunities for individual expression

Several students even mentioned this freedom as having an impact on teaming: one student described conflict with teammates when their interpretations of the rubric differed, and another described differences of opinion among teammates about how to meet the rubric expectations as a positive thing, as more approaches had the opportunity to be valid. One student commented that the holistic rubric system “worked well because it was clear what the final requirements of the project were and it was clear how the projects would be evaluated, yet it still left room for creativity when it came to deciding how to accomplish different tasks and what aspects of the project we viewed as more important.” Another student found that the system helped them to “know what was important to include both technically and more qualitative things like stability analysis, but it didn't restrict us in how we presented this information.”

Drawback: Students found the holistic rubrics too abrupt a shift from previous experience

While many students referenced that the holistic rubrics were difficult or challenging in some way, some students explained further that their difficulty with the open-ended rubrics stemmed from the significant shift these holistic rubrics represented from what they had been used to in high school, or even in other college classes. As one student put it:

I think the system is ideal in its nature, but for a lot of students, this was the first time experiencing engineering on a level like this and as such it was hard to understand what is expected. A lot of my memos, regardless of me having substantial prior experience, didn't exceed expectations mostly because of the vagueness of the expectations, and I don't think a checklist laying out every single [sic] criteria for an A is necessary, but I think a little more guidance or a draft stage might be beneficial in the beginning.

Several students suggested that the holistic rubrics might even be introduced slowly (phased in over the first few assignments, or transitioned to after several assignments had been graded with an analytic rubric) to make the adjustment easier.

Benefit: Students believed holistic rubrics were more reflective of “real world” expectations

This is perhaps unsurprising given the client-centered framing of the holistic rubric and accompanying assignment descriptions, but several students mentioned that, though the

open-ended rubrics were more challenging to respond to, they made for a better experience because they better mimicked expectations students anticipated in the non-academic world.

Drawback: Students felt that the holistic rubrics kept them from delivering their “best work”

Many students indicated that they thought it would have been easier for them to do their best work (which in every case meant earning a higher score--an interpretation of “good work” that we don’t want to encourage, but one that is understandable) on their deliverables had the rubrics been more specific and directive about the criteria required for an A, though many of them also refrained from suggesting a return to a check-box style rubric:

For me, this system did not work because it made it very difficult for me to provide the necessary information for some of the homework assignments and project components. Most of the time, I thought I had addressed the problem fully like the professors wanted it, but it would turn out that I had focused too much attention to one aspect of the assignment that was not as important as I thought. Perhaps it is just me, but I feel that setting clearer guidelines do not hinder a student's ability to do excellent work. Rather, clearer guidelines allow students to focus their efforts on the important areas without forcing them to do it "the right way." Personally, I feel clearer guidelines or suggestion lists would have been helpful in letting me succeed in this class. However, I do not feel that a series of check boxes would be an appropriate change.

This response isn’t surprising, as it’s possible--even likely--that some students would have received higher scores on assignments had the rubrics been designed to make explicit how high scores could be earned; however, this feedback indicates that we need to do a better job communicating the rationale behind the holistic rubric approach (i.e., that the decision-making involved in determining the best rhetorical approach to responding to the holistic rubric was part of what was being assessed in the reports) and preparing students to do this kind of rhetorical situation analysis.

Drawback: Students found the holistic rubrics “worrying”

This feedback could very well be a side effect of the learning curve related to using the holistic rubric, but enough students referenced being made worried, anxious, or frustrated by the experience of writing to the new rubrics that it seems to warrant a mention, particularly since increased anxiety about assignments was one of the drawbacks we had anticipated and had hoped to alleviate. Several students referenced worry or frustration particularly when talking about faculty expectations (i.e., the source of the worry was lack of certainty about what we expected from the assignment), while others tied their concern to uncertainty about the grade they would receive.

Faculty Experiences with the Holistic Rubric System

At the time of this writing, we have completed only 1.5 semesters using the new holistic rubric system, so our opinions of the system are still under development. Still, in reflecting on our experiences teaching and grading with this new rubric system, we have identified a few preliminary benefits and drawbacks of this approach:

Benefit: Better ability to differentiate adequate from exemplary work

We have found that the primary benefit of this approach so far is the way in which it enables us to recognize student work that excels in ways we didn't anticipate. One of the primary drawbacks of applying the analytic rubric to an open-ended design project is that we frequently found ourselves faced with the desire to reward approaches that we hadn't encoded in the rubric, but rewarding those approaches felt unfair to those students who had faithfully (though less impressively) delivered what the rubric had requested. (After all, more students would likely have taken the time to--for example--create detailed simulations of their vessel's thrusters to justify the shape and size of their shrouds had they known that doing so would be rewarded in the grading.) This resulted in students who had done exemplary work--in ways that weren't valued by the analytic rubric--receiving the same grade as students who had produced reports that were merely adequate. With the holistic system, we could recognize the effect of these exceptional design and reporting choices on the overall impact of the students' work.

Benefit: Emphasis on overall impact of report in conversations about grades

A primary benefit of the holistic rubric was that it enables—even encourages—a different framing when students come to talk about why an assignment has received a particular grade. Instead of those conversations being couched in terms of points (and as was frequently the case, in terms of “how can I get these points back”), we can explain a grade in terms of the impact on the audience of individual issues within a report, or of the cumulative impact of multiple smaller, perhaps unrelated issues. This is particularly useful in discussing with students the importance of communication concerns when documenting a design project, as it enables us to reinforce the idea that even brilliant ideas presented poorly can fail to impress an audience. Additionally, because the rubrics combine the technical and communication concerns, these conversations about grading by necessity need to involve the entire faculty team together, which helps us to reinforce the joint impact of technical and communication concerns in the overall impression made by a report.

Drawback: Learning curve in switching from analytic to holistic rubric

All of the course faculty experienced a learning curve in switching to the holistic rubric. This issue was particularly pronounced for the technical faculty member. Because the previous technical rubric was very checkbox-based (i.e., students received points for addressing certain

content in their reports and didn't earn points if that content was omitted), it was much easier to grade presentations and reports: all that was required was a yes or no determination about whether students had included required information. The new holistic rubric complicates this in two primary ways: first, it requires the instructor to hold an overall picture of a "good report" in her head at all times, which is challenging since--as we've already established--there are myriad ways of documenting a project well; and second, the technical grading now requires the instructor to assess not just the presence of certain information in a report, but whether that information is presented correctly and well given the overall project context. Even for an experienced instructor, trying to keep the holistic impact of individual content items and the entire report in mind while grading for specific required technical content is a challenge--one that required a lot of scrolling back and forth while grading written reports to check for required information and to evaluate the overall technical narrative.

Drawback: The holistic rubric complicates preparing new faculty to teach the course

For the communication faculty, the transition posed a particular challenge: when a new communication faculty member joined the team, it became clear how much more difficult it can be to apply a holistic rubric to assignments you're unfamiliar with. Members of the communication teaching team who had taught this course together for multiple semesters already had a shared understanding of the expectations of each assignment, so applying the holistic rubric in equivalent ways wasn't difficult; however, for the instructor new to the teaching team, the holistic rubric did not provide as much guidance as an analytic rubric would have. It was useful for thinking broadly about a piece of work ("Does this meet professional standards?" or "Could I forward this document to a client?") but was much less useful than a well-thought out analytic rubric in communicating the established expectations and value judgments of the other more-experienced instructors. On a practical level, because the rubrics did not establish weighted categories for the different aspects of the reports, it was difficult for new instructors to determine what to comment on in a given assignment, and how heavily to weigh particular issues or achievements.

Next Steps: Revisions to the Holistic Rubric System and its Implementation

Despite the implementation challenges, our experiences with this holistic rubric approach have convinced us that this new approach is worth continuing, with some refinements:

Providing additional examples of more- and less-effective approaches to assignments

The student feedback has convinced us of the need to provide more examples of the range of rhetorical approaches to the assignments in our course, though we haven't yet established what form these examples will take. Ideally, we'd like to develop a searchable corpus of representative examples of student reports, but that is much more a long-term solution--for the near term, we

are considering developing a set of annotated example reports that represent both effective and not effective responses to the course prompts. We would also plan to develop activities that involve engaging with and discussing these examples, in the hopes of discouraging students from treating the examples as a series of approach options to select from and/or avoid.

Refining the scoring categories to better represent the needs of the assignments

In conversations as we prepared this paper, we have realized that we have been using the holistic rubric differently. All but one of us have used the rubric as identifying discrete bins, assigning student work to one of the bins. The remaining instructor has instead treated the holistic rubric as identifying marked points on a continuous number line, and fitted student work anywhere along that number line. In future semesters, the instructional team intends to come to consensus in advance about how the rubric will be applied, to ensure more consistent grading. While we may maintain the scoring bins as established in the rubric, we are also currently discussing several revisions to the approach, the most likely being a compromise between the bin and continuous line systems: by creating (and thoroughly describing) more possible scoring midpoints on the rubric, and making clear that scores above and below the midpoints are possible for work that doesn't fit completely into one category, we can enable the more incremental scoring that seems appropriate for our students' work, without setting ourselves up to try and differentiate meaningfully and consistently between a report that earns an 85.5% and one that earns an 86%.

Additionally, the technical faculty member has proposed a revision to the technical side of the grading, one inspired by the fact that the technical points for many assignments in our course are determined by a student grader: a combination analytic/holistic rubric system, wherein the analytic rubric is applied by the student grader, and the holistic rubric is applied by the faculty member. We are still fine-tuning how this might work, but the current thinking is a two-pass grading system, as follows:

1. Initial hurdle for acceptability: a certain number of the technical points will be assigned to cover the presence of all required items (i.e., how completely the student has responded to the assignment). A student grader should be able to handle this portion of the grading, as it involves determining the presence or absence of items, and not the effectiveness or accuracy of their presentation. (We don't in any way mean to impugn the ability of the talented students who serve as graders for our course; policies for student graders within our College of Engineering forbid students from undertaking grading that requires subjective judgment.)
2. Client-readiness: The remainder of the technical points will be applied according to the holistic rubric, therefore capturing the *quality* of the technical discussion.

By delegating the requirements checking to the grader, the technical instructor has more time to focus on and respond to the technical narrative. If a grader is not used, the technical instructor

can grade the reports in two passes: first for acceptability and second for client-readiness. This approach should help alleviate the difficulties mentioned earlier in switching from an analytic to holistic rubric.

Conclusion

This paper attempts to capture and assess an in-flux change in our pedagogy, and we will continue to refine our grading system. Our previous analytic rubrics had serious limitations on both the faculty and student side. A holistic rubric, while potentially more challenging to use, appeared to be an overall better choice for this class. In order to gauge our students' impressions of the rubric, we included a question on our end-of-semester exit survey asking students to comment on how the holistic rubric system worked (or didn't work) for them.

In general, though many students seem satisfied with the rubrics and appreciate their flexibility, students experienced anxiety and requested additional examples of design reports and presentations. We will work over summer 2017 to assemble a set of annotated examples, perhaps in the form of a searchable corpus.

Faculty identify three specific drawbacks to the holistic rubric: a learning curve associated with using the new rubrics; difficulty keeping all requirements, particularly technical requirements, in our heads simultaneously; and difficulty experienced by new faculty (who lack extensive experience with the course and its assignments) in applying the rubric. Benefits of the holistic rubric include: better ability to differentiate adequate from exemplary work, an emphasis on overall impact of report in conversations about grades, and better cohesion between technical and communication aspects of the course.

Despite our growing pains, we believe that this transition to a unified, holistic rubric has been an improvement to the course, and we plan to continue its use and further refine our grading of the DBT project presentations and reports using this new system.

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Appendix A: Sample Separate Rubrics for Communication and Technical Grading, used before AY 2016-2017

Engineering 100-600

Introduction to Engineering

Fall 2014

BATHYSPHERE REPORT TECH COMM EVALUATION RUBRIC

Team Name:

_____ / 3 pts	<p>Physical Format of Report</p> <ul style="list-style-type: none"> • Report has title page with all appropriate information. • Report contains section headings: all required sections, plus content-based headings and subheadings in body of report. Structure, format, spacing, and alignment always consistent and appropriate. • Numbered pages / Single-spaced / One-inch margins / Standard block formatting (for "formal" rpts.)
_____ / 6 pts	<p>Executive Summary, Introduction, and Conclusions & Recommendations</p> <ul style="list-style-type: none"> • Clear motivation, org. problem, task, purpose of document, findings; conclusion & recommendation statements effective. • Enough detail to fully orient the intended audiences. • Overviews the structure of the report and reflect thought process. • Conclusions & recommendations contain only information previously presented in main body of report; no new content there.
_____ / 3 pts	<p>Audience Awareness</p> <ul style="list-style-type: none"> • Report meets the needs of intended audience and mixed audience (i.e., client's questions answered via presented results). • Discussion of scenario, client's needs, etc. accurate. • Written at correct level of technicality, level, & tone. Concepts and terms explained appropriately.
_____ / 5 pts	<p>Structuring of Ideas</p> <ul style="list-style-type: none"> • Overall organization of content clear. Ideas logically ordered into sections, and explicitly reflect priorities of importance. • Enough evidence to support all claims and body of report organized by claims related to criteria. Sources credible. • Introduction to each section clearly orients the reader. • Paragraphs concise, coherent, and linked with effective transitions (cohesion). One topic per paragraph (unity). • Each paragraph has adequate topic sentence at the beginning, containing main point of that paragraph.
_____ / 5 pts	<p>Mechanics and Style</p> <ul style="list-style-type: none"> • Correct grammar, spelling, capitalization, precision of word choice, and punctuation. • Well edited and proofread. Good mix of sentence structure; reads smoothly & unified.
_____ / 8 pts	<p>Visuals</p> <ul style="list-style-type: none"> • Figures are not crowded. Contents are self-evident, findings are obvious. • Figures included where required and support argument. • Illustrations, photos, etc., show viewing angle(s) and dimensions and have units, callouts, etc. • Axes clearly marked and units clearly designated. Sufficient white space surrounding. • Labels and legends are clear. Lines clearly visible. • Title reflects subject. Table/figure numbers consecutive. Standard designations for visuals. One title and number per visual aid. • Photos, diagrams, etc. are clearly reproduced (not faint, grainy, or pixilated, for example).

*Some categories inevitably overlap; this rubric is only a general guide, not a rigidly discrete division.

TOTAL: _____ / 30 pts

Appendix B: Sample Detailed Description of “Client Ready” Deliverables (Accompanies Holistic Rubric, one document like this per DBT project)

Grading of the Bathysphere Reports

The bathysphere reports (oral and written) are worth up to 60 points each. Grading for these assignments comes from the overall impact of the entire communication, not from adding up the number of errors and subtracting a particular number of points. You can do fantastic work but make one major error--misspell the client’s name or describe buoyant force incorrectly--and it’s still an ineffective communication.

We’ll follow the [general course rubric](#), which describes our expectations in terms of how “ready” the communication is for the real world and how that maps onto the points you’ll earn. Here, we describe the characteristics of a client-ready bathysphere report (oral and written):

The design is communicated clearly, using both relevant visuals and clear descriptions. Visuals are well done, following expectations outlined in class. At least one image should have the major components of the vessel labeled and dimensions clearly marked (not necessarily on the same image: use your best judgment of what is most clear). The description of the design should include a discussion of whether ONR specifications are met (and they should be) and a clear/extensive description of your design rationale and major components of the bathysphere. The description of the design and the rationale for it should emphasize any unique aspects of the design. The table of principal particulars includes all of the relevant information, and it’s clear that this information was collected appropriately.

Analysis of/ description of vehicle stability is clear and thorough. A mass budget is included (detailed in written work/ simplified for presentation) and follows best practices for table inclusion and formatting. Analysis, based on calculated KG and calculated/estimated CB, is done correctly and explained well. Discussion of stability emphasizes vessel strengths or acknowledges vessel weaknesses while alluding to opportunities for improvement at full scale.

Performance description is clear and correct. Performance results from testing and competition are included and compared adequately (discrepancies should be explained). It is clear from the discussion where these numbers come from and what they mean. Performance analysis, based on these results, seems both appropriate and believable, and it highlights strengths of vessel design.

Scaling for the ocean environment is clear and correct. Geometric, speed, and weight scaling information (both how you did it and what it means) are clearly communicated, and any tables

are well done. Sources of error and assumptions are acknowledged (and impacts are discussed, when appropriate). Discussion of these values includes assumptions about and recommendations for changes in materials and design improvements.

All of these things are communicated in a way that is clear, concise, and correct. The organization of the document makes the “story” easy for the audience to follow. Material is provided in an order that makes sense (following genre conventions, maintaining a consistent order, etc.). Prose is easy to read and follows expectations of technical writing in English. Relevant information is included in the body of the text, and additional information is included in appendices or hidden slides (when appropriate). Non-prose information in the form of tables, figures, and equations is included when appropriate, explained well, and formatted as described in class (e.g., in written work, these things are introduced before they appear, numbered [and tables/figures are captioned], and explained. In a presentation, these things are clear, captioned on the slide, and explained well verbally). The content is presented in a way that invites the audience to be engaged (formatting of written document or supporting slides is pleasing, speakers are clear and convey confidence and expertise, etc.). In all ways, the communication seems polished (written work is proofread, transitions have been rehearsed, etc.).