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## Interdisciplinarity@WMU- Phase One planning Template

- 1. Brief Overview:** Provide a brief overview of the proposed interdisciplinary initiative. What types of questions would the initiative ask? What types of complex problems would it seek to solve?

We propose to promote statistical literacy and train our students to be statistical literates. Statistical literacy is “the ability to understand and critically evaluate statistical results that permeate our daily lives – coupled with the ability to appreciate the contributions that statistical thinking can make in public and private, professional and personal decisions” (Wallman, 1993). In our modern data-driven technological world, statistical literacy is crucial for everyone (Gal, 2004; Giovannini, 2008; Schield, 2010; Watson, 2014). Media statements, research reports, and claims in data-based products require the understanding of how data is sampled from a population and conclusions may be subject to errors. As in Sharma (2017), “[C]itizens without statistical literacy may not be able to discriminate between credible and incredible information and will have difficulty in interpreting, critically evaluating and communicating reactions to such messages (English & Watson, 2016b; Gal, 2004; Galesic & Garcia-Retamero, 2010)”.

Statistical literacy is different from statistical competence, which is the paradigm in introductory statistics courses at the university level. Rumsey (2002) defines statistical competence as “the basic knowledge that underlies statistical reasoning and thinking.” Nikiforidou et al. (2010) point out while students often develop the ability to apply definitions and formulas for computation, they often do not have the ability to interpret data correctly and solve real-world problems. McLaughlan & Schonlau (2016) found no differences in statistical literacy between students who took an introductory statistics course and those who did not.

In light of this, the Statistics Department feels that it is time to take a university-wide approach to address this important proficiency. As a way of promoting statistical literacy at WMU, we propose modifying our STAT 1600 (Discovery with Data) course in such a way that it focuses more on statistical literacy.

- 2. Impacted units:** What existing units, programs, and colleges would be involved in the proposed initiative? What other possibilities for collaboration across campus or in the broader community might exist now or in the future?

Our statistical literacy course will be accessible to both STEM and non-STEM majors. While the core unit for the initiative of promoting statistical literacy would be the Department of Statistics, in the spirit of interdisciplinarity, other units would be encouraged to get involved and contribute to the initiative. We have not yet contacted other departments because it is still preliminary, but we welcome their participation in promoting statistical literacy and in revamping the statistical literacy course.

As an example, the Department of Political Science could easily get involved. One of the topics in the statistical literacy course can be about better reading and understanding political polls. For instance, if a news media reports that a candidate is leading another candidate by 51%, but

the margin of error is 4%, then this means that the actual support for the candidate is between 47% and 55%, so it is not conclusive as to which candidate is leading. The students would need to understand that the poll results can vary a lot based on the participating group and on the survey method.

Moreover, data-based arguments and statistical claims exist in almost all disciplines, and all departments can help the Department of Statistics to build field-specific examples and real-life case studies for this course. This will greatly help promoting statistical literacy across the WMU campus.

Such collaborative work on teaching introductory statistics can lead to joint grant proposals and papers on statistical education, not only within our university but also in the broader community. For example, faculty in our department have connections with Statistics faculty at Grand Valley State University. Dr. John Gabrosek (former editor of the *Journal of Statistical Education*) and our alumni Dr. Bradford Dykes would be interested in how to advance statistical literacy in introductory courses.

- 3. Impact on teaching, learning, and curricula:** Describe the anticipated impact of the proposed initiative on teaching, learning, and curricula. How might this initiative help to grow enrollment, including by reaching new audiences of learners through continuing education, dual enrollment, or professional certification? How will the proposed initiative positively impact the training of undergraduate and graduate students? How does it enhance our institutional commitment to diversity, equity, and inclusion?

The proposed initiative will positively impact training for students. With the increased importance of statistics in everyday life and the workplace, we need to train our students to be statistical literates. Statistical literates will become able to understand the quantitative evidence in knowledge building, evaluate number-based claims in the media, and critically assess the data-driven products in their workplace.

Since data-driven decision making is very important in any type of career, we need to train our students to acquire the ability to interpret and critically evaluate data-based information and arguments. Equally important is the ability to discuss their opinions about the implications of such information. The proposed initiative will better prepare our students for the modern workplace. Moreover, students will be taught by statistical experts who can help build a stronger foundation that they can then apply to their field of expertise.

Students will also learn what types of bias can result from wrongful collection of data and challenge misleading prejudicial interpretations of statistical results that may be presented in the media. Statistical literates will be able to recognize the existence of confounding variables when they read an article like the *Forbes* 2012 article titled "Chocolate And Nobel Prizes Linked In Study". Similarly, they will not just focus on the claim that Pfizer's vaccine is 95% effective against COVID-19, but also understand that it is still preliminary as the argument is based on 162 cases in the placebo group and 8 in the vaccine group in over 43,000 total enrolled participants and only 28 days after the first dosage.

The proposed initiative is also expected to promote diversity, equity, and inclusion. Since the course promotes discussion among students from different backgrounds, they will be exposed to different perspectives, learn how to effectively deliver their opinions to others, and respect opinions different from theirs.

- 4. Impact on research and creative activity:** Describe the anticipated impact of the proposed initiative on research and creative activity. How will this initiative promote discovery and creative scholarship? How might it result in increased external funding?

The proposed initiative will have impact on research and creativity at two levels: 1) students, and 2) faculty.

Statistical literate students will have a strong foundation of statistical understanding and build critical thinking skills. This will greatly help them do creative work in their fields. For example, when a music student wants to understand which warm up procedure is the most effective for his trumpet performance, he can first find a way to quantify the performance based on the warm up method (e.g., proportion of missed notes in the 6 alternating sets of 4 loud and 4 soft attacks of high concert Db's separated by 4 beats at 60 bpm). He could then decide which variety of warm-up methods would be compared, collect data across multiple days, and evaluate the results.

Promoting statistical literacy will also benefit the involved faculty. As statistical literacy is an important topic nowadays, other faculty involved in this initiative can ask for an external grant and work on statistical education research. For example, faculty in the Department of Statistics and Mathematical Education researchers in the Department of Mathematics could submit proposals to the Statistical and Research Methodology in Education (Stats/Methods) grant program (CFDA 84.305D) from National Center for Education Research.

- 5. Efficiencies and/or cost savings:** How might the proposed initiative contribute to increased efficiencies and/or cost savings, for example by reducing administrative positions (e.g. chairs/directors), sharing staff support services and/or by sharing facilities?

Most likely, there will not be any immediate benefit in terms of cost savings with this proposal; at least in terms of the examples given above. As far as the department is concerned, this course is already being offered so the proposed modifications will not significantly impact existing resources. For example, the Statistics Department already has instructors for this course and has developed software that generates tests, projects, and homework exercises for its introductory statistics courses. The department plans to utilize this same software for the proposed changes.

Potential cost savings can come from having one foundational statistics course across campus as it is implemented in many other universities. The proposed changes to our STAT 1600 course would serve this purpose. Thus, the faculty involved in introductory statistics in other departments would no longer need to teach their own introductory statistics courses. Instead, they can teach courses on more field-specific topics.

- 6. Impact on course offerings and workload:** At present, proposed initiatives will only be feasible and sustainable if they can be supported by existing resources, including instructional capacity, faculty and staff time, and facilities. Will the proposed initiative streamline existing course or program offerings? Could the initiative help create more equitable and sustainable workload for faculty, for example, by reducing the need to offer under enrolled courses, reducing the frequency of course offerings or eliminating the need to teach some courses?

It is a well-known fact that several departments at WMU teach their own statistics courses, undoubtedly contributing to the "silo" mentality that the interdisciplinary initiative is (presumably) supposed to be disposing of. Over the years, the Department of Statistics has engaged in efforts to try and remedy this situation. However, despite our efforts, this has been met with resistance from other departments, except for a few situations such as Business Statistics.

There are two myths that are typically used to thwart these efforts. The first is the “discipline specific” myth that students only need to be taught statistics in the context of their specific field of interest while the second argument often suggests that the Department of Statistics is too formula-based. Regarding the discipline specific myth, statistics should be viewed, utilized, and taught as a universal language used to communicate across multiple disciplines, not just to solve problems in a specific discipline. As for the formula-based myth, statistical literacy courses focus considerably more on understanding of general concepts and interpretations than calculations and methodology. Thus, the Department of Statistics feels that the proposed statistical literacy course will work to dispel these two myths.

That being said, the Department of Statistics is elated that other disciplines recognize the need to train their students to be scientifically literate and numerate. A university-wide statistical literacy course that is accessible to all disciplines is a good first-step in this direction. Moreover, it would eliminate the need to teach potentially redundant introductory statistics courses across campus.

- 7. Additional Information:** What additional information would you like to provide in support of this proposal?

References are as the following.

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## **8. Contact**

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