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Using Learning Maps and Bloom's Taxonomy to Develop a New Instrument to Assess Knowledge Transfer from Physics to Statics Courses.

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Marlee is a fourth-year undergraduate student in the College of Engineering and Mathematical Sciences, pursuing a degree in Civil Engineering. Marlee has been enjoying the collaborative aspects of this project, particularly working along side professors from engineering and physics disciplines. Marlee hopes that our research into using Learning Maps and Bloom's Taxonomy to enhance knowledge transfer from physics to statics courses, will be beneficial to engineering students. Marlee is looking forward to continuing to assist research and seeing further advancement in course development.

Using Learning Maps and Bloom's Taxonomy to Develop a New Instrument to Assess Knowledge Transfer from Physics to Statics Courses

I. Introduction

This paper presents the design of a physics problem set called Statics Knowledge Inventory (SKI) that can be deployed for engineering students to assess their retention of physics knowledge at the start of an engineering statics course. The design of SKI is based on a Learning Map (LMap), our new method of organizing physics concepts into a hierarchical structure for more efficient and effective identification of physics concepts that are most relevant to statics courses. The results of the LMap analysis guide the development of problem sets for SKI. This work is part of an ongoing NSF-IUSE Learning Map project piloted during the spring and fall semesters of 2024. The LMap method briefly described below is rooted in the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model [1] and Backward Design [2, 3] and applied to the design of course sequences that align learning outcomes, assessments, and instructional practices. We report here the current results of implementing and testing the new Statics Knowledge Inventory.

A. Background

Student success in engineering education depends on their performance in prerequisite course sequences, which require the ability to retain and transfer knowledge and skills across courses. Incomplete knowledge transfer in foundational courses like Calculus and Physics can result in struggles in advanced courses, course repeats, delayed graduation, degree changes, or stop-outs [4, 5]. These challenges are heightened by the complexity of engineering curricula and disproportionately impact historically marginalized students, creating barriers to success [6]. The NSF-IUSE LMap project aims to address these issues by piloting the LMap Framework, an instructional design approach to align learning outcomes, assessments, and instruction in undergraduate STEM course sequences [7]. Central to the framework is the analysis of existing curricula to identify interdependent learning outcomes (ILOs), defined here as course learning outcomes (CLOs) that may be established in a prerequisite course and then built upon in subsequent courses, ideally to higher Bloom's levels [8]. Modeled after Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model [1], this analysis is presented as visual, hierarchical maps of course topics, sub-topics, and subordinate skills (concepts/procedures) that students must master in one course to be successful in the next. Here, we describe (1) the development of learning maps for the Physics-Statics course sequence, (2) the use of these maps to identify areas where knowledge transfer is expected, and (3) the design of a new instrument to assess students' knowledge transfer from physics to statics based on this analysis. Refer to [7] for details on the full scope of the NSF-IUSE LMap project.

B. Motivation

The primary motivation of SKI was to evaluate and improve students' understanding and retention of physics concepts at the start of a statics course. At the author's institute, civil, biomedical, and mechanical engineering students take Physics for Engineers course in the second semester of their first year, followed by Statics in the first semester of their second year. Environmental engineering students follow the same time frame but take Applied Mechanics instead of statics which covers statics concepts. SKI includes a combination of multiple-choice questions (MCQs) and multi-part procedural problems. Unlike widely used concept inventories, which are primarily designed to assess learning gains within a single course, our primary goal was to develop a tool that could be used to evaluate *knowledge retention* across courses. Further, we wanted to inspect students' problem-solving approaches and critical thinking.

To achieve this, we used the LMap approach to identify overlapping concepts and topics between physics and statics courses, referred to here as interdependent learning outcomes (ILOs). This process involved consultation with instructors, reviewing syllabi, examining textbooks, and analyzing course content to create tables outlining ILOs for each overlapping topic. A key feature of SKI is the inclusion of procedural problems, which are absent from the Force Concept Inventory (FCI) [9] and Statics Concept Inventory (SCI) [10]. These multi-part procedural problems were designed to evaluate students' thought processes and intermediate steps, offering deeper insights into their conceptual understanding and problem-solving skills beyond the scope of final answers typically assessed through MCQs.

Concept inventories are standard, validated assessment tools used in a variety of STEM disciplines to quantify knowledge acquisition through pre- and post-tests. Relevant to the physics-engineering mechanics course sequence are the Force Concept Inventory [9], the Statics Concept Inventory [10] as well as the Test of Representational Competence with Vectors [11] , and the Dynamics Concept Inventory [10]. While our approach to developing the SKI models that of traditional concept inventories, it differs in the following ways:

- Categories of problem sets based on Learning Map analysis
- Includes both conceptual and procedural problem types
- Is intended to be deployed at the beginning of a statics course

This paper describes the development of a knowledge retention inventory for the Physics-Statics transition and preliminary testing over two semesters at the author's institution.

II. Development of Learning Maps for Physics-Statics

Learning Maps were developed following the ADDIE model [1]. ADDIE has been used extensively in miliary applications to design sequential trainings that ensure complete mastery of a topic or skill before students can proceed to the next stage. Applying the approach to a course sequence requires a detailed analysis of course topics, sub-topics, subordinate skills, and learning outcomes that students develop first within a prerequisite course and later build upon in subsequent courses.

The overlapping concepts and topics in physics and statics courses were visually represented using LMaps for each major topic in the University of Vermont's engineering course on statics. Figure 1 shows an example for one component of the LMap for the statics course topic *Vectors.* The outcomes were mapped and organized for transfer of topics into tables, which were further broken down into specific learning outcomes at the sub-topic level. See Table 1 for a detailed breakdown of the outcomes for *Vectors.* The second column in Table 1 lists the learning outcomes in the statics course and the third column lists the associated learning outcomes in the physics course. Each learning outcome follows the verbs of Bloom's taxonomy, which can be directly linked to the assessments.

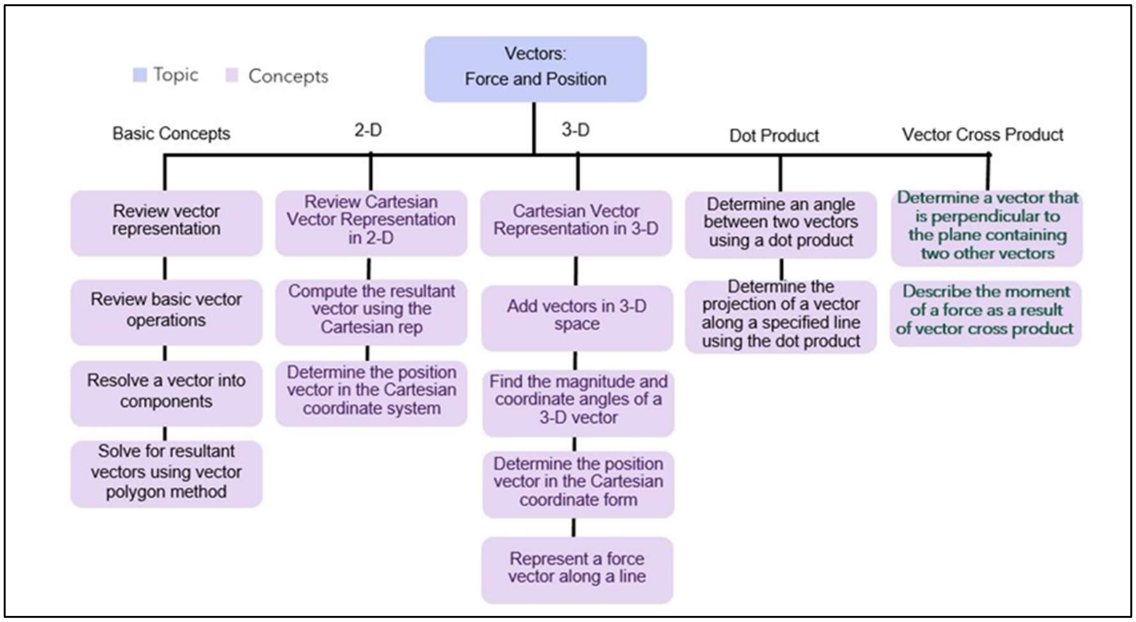


Figure 1: Example of Statics and Physics LMap at the sub-topic level

Table 1: Example of results from LMap for *Vectors*

Vectors: Force and Position		
Statics Unit/Topic	**Learning Outcomes in Statics**	**Associated Learning Outcomes in Physics**
Review the basics of vectors	Represent vector magnitude and direction	Make a graphical representation of the magnitude and direction of a vector
Vector operations	Represent basic vector operations	Add and subtract vectors graphically
Vector components	Resolve a vector into components	Find coordinates from the graph of a vector
Resultant vector	Solve for resultant vector using vector polygon method	Find the magnitude and direction of the resultant vector
Cartesian Vector Representation in 2D		
Review the basics	Represent 2D vectors	Represent the magnitude and direction of a vector in 2D
Resultant for 2-D vector	Compute resultant vector using Cartesian representation	Add and subtract 2D vectors. Find resultants
Position vectors	Determine the position vector in the Cartesian coordinate system	Find the coordinates of a 2D vector
Cartesian Vector Representation in 3D		
3D vector representation	Find the magnitude and coordinate angles of a 3D vector	Find the magnitude and direction of a 3D vector
3D vector addition	Add and subtract vectors in 3D space	Add and subtract 3D vectors. Find resultants
3D position vector with Cartesian coordinates	Determine a position vector in Cartesian coordinate form from given geometry	Determine a position vector in 3D
3D force vector coordinates	Represent a 3D force vector directed along a line	Graphically represent a 3D vector

III. Identification of Knowledge Retention Topics

After consulting with the statics instructors at the author's institution, we identified the overlapping topics that students typically find most challenging upon entering the statics course. These topics became the focus for developing the first SKI deployed in spring 2024 (SKI 1.0). These problems require students to perform calculations, demonstrate their work, assess their conceptual understanding of key topics, and allow the instructors to assess essential prerequisite skills like drawing free-body diagrams (FBDs), computing forces and moments, and performing basic vector calculation and unit conversions. Problems were selected and adapted from physics and statics textbooks, supplemented by instructor-designed questions to ensure full coverage of the selected ILOs.

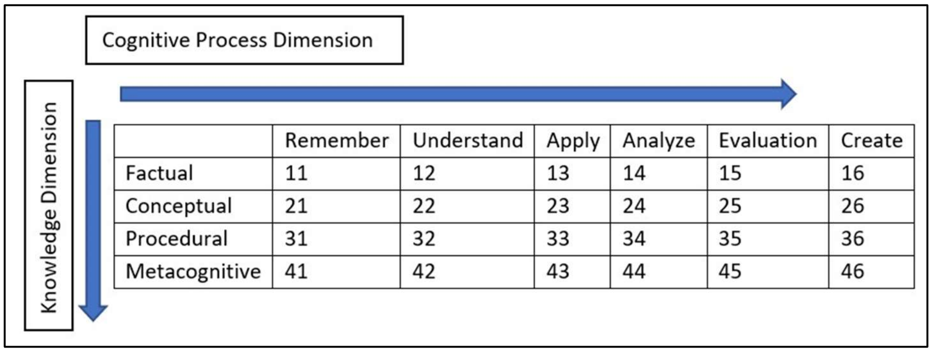
IV. Development of the Statics Knowledge-Retention Inventory (SKI)

The Pilot SKI (SKI 1.0) administered in Spring 2024 consisted of fifteen problems, including eight MCQs and seven procedural problems. The second problem set, administered in Fall 2024 (SKI 2.0), included eleven problems, five MCQs, and six procedural problems. Both problem sets incorporated drawing FBDs and multi-part procedural problems, allowing us to evaluate students' conceptual understanding, problem-solving skills, and computational accuracy. We also included two reflective questions with each problem in both sets to assess students' self-reported confidence and perceived difficulty. Additionally, both problem sets concluded with two reflective prompts asking students to (1) reflect on where/when they had learned the relevant concepts or problem-solving approaches and (2) invite feedback on their overall experience completing the problem set. These reflections provided us with valuable insights into students' confidence, problem-solving approach, and thought process.

In SKI 1.0 and SKI 2.0, we distributed problems across several topics. We included one problem from *Basic Concepts - Unit Conversion* in both sets. The topic, *Vectors - Force and Position*, had six problems in SKI 1.0 and five in SKI 2.0. *Equilibrium of Particles* was included in two problems in SKI 1.0 and one in SKI 2.0. For *Moment of a Force*, we reduced the number of problems from four in SKI 1.0 to two in SKI 2.0. We included two problems from *Friction* in both versions.

V. The Role of Bloom's Taxonomy in the Design of SKI

We classified each problem in the SKI using the revised 2D Bloom's Taxonomy [8] and its 3D representation [12], mapping them onto a 6x4 matrix composed of six cognitive processes and four knowledge dimensions (see Figure 2). The revised Bloom's Taxonomy created by Anderson and Krathwohl [8] introduces an additional dimension known as the Knowledge Dimension. This dimension categorizes four types of knowledge, ranging from concrete to abstract: factual, conceptual, procedural, and metacognitive, which learners are expected to acquire. The Cognitive Process Dimension illustrates a progression of increasing cognitive complexity, moving from lower-order thinking skills to higher-order thinking skills, including remembering, understanding, applying, analyzing, evaluating, and creating.



	Remember	Understand	Apply	Analyze	Evaluation	Create
Factual	11	12	13	14	15	16
Conceptual	21	22	23	24	25	26
Procedural	31	32	33	34	35	36
Metacognitive	41	42	43	44	45	46

Figure 2: 6x4 Matrix for identifying learning outcomes across cognitive processes and knowledge dimensions.

Incorporating Bloom’s taxonomy levels into the problem set not only helps us organize learning outcomes and maintain the integrity of the design but also plays a critical role in raising awareness among both students and instructors regarding Bloom’s taxonomy. By understanding the cognitive levels associated with each topic, instructors can design instructional activities more effectively, while students can better comprehend the expectations and learning outcomes for each area, enabling them to prepare for tasks across different skill levels and cognitive complexities. Our goal was to integrate multiple Bloom’s levels into a single procedural problem to provide students with a clearer framework for problem-solving and to promote thinking guided by Bloom’s lower-to-higher Bloom's levels.

Pilot Study: The SKI 1.0 was administered to nineteen students as a pilot in the Spring 2024 statics course, with all responses graded by two instructors of the research team independently using the same rubric in Gradescope [13] an online grading tool. The revised version (SKI 2.0) was deployed to one hundred and thirty-six students in the Fall 2024 statics course. To facilitate comparison with the SKI 1.0, we used only thirty randomly selected student responses from the Fall 2024 (SKI 2.0), which we graded using the same rubric with minor variations to account for the added steps in some multi-part procedural problems. Problem sets were distributed as paper copies and administered during the first recitation session of each semester, held in the first week of classes. Students were informed in advance and given one hour to complete them.

VI. Results and Discussion

Upon initial analysis of SKI 1.0 results, we found that the majority of students struggled with procedural problems across all topics. Some students pointed out that lack of time (one hour) and the wording of certain problems as common issues. In response, we revised the problem set for fall 2024 (SKI 2.0) by removing a few MCQs and restructuring the procedural problems using a scaffolded approach with multiple parts. Our aim with the second problem set was to experiment with different levels of Bloom’s taxonomy, ranging from lower to higher-level thinking within the same problem.

This analysis compares the overall results from both SKI 1.0 and SKI 2.0 to evaluate the effectiveness of the problem sets and the impact of the revisions. Student performance on individual problems is discussed below, focusing on SKI 2.0.

Table 2: Percentage of students with correct answers for MCQs in SKI 1.0 and SKI 2.0

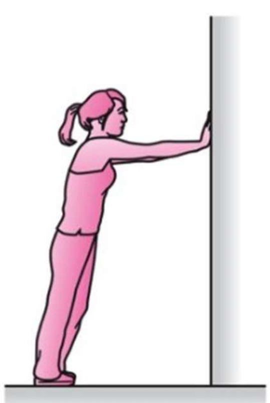
SKI 1.0 (Spring 2024)		**Unit and the Topic**	**SKI 2.0 (Fall 2024)**	
Question#	Percent		Question#	Percent
2	68	2D Unit vector representation	2	83
3	79	Vector addition: triangular method	3	80
7	68	3D vector magnitude	6	73
8	37	Force vector components & static equilibrium	Not included	
10	74	Moment of a force	8	73
12	5	Moment about a point (3D problem)	Not included	
13	63	Moment of a force	Not included	
14	42	Static friction and equilibrium	10	40

Overall Performance in MCQ: Of the eight MCQs in SKI 1.0, five were included in SKI 2.0 (see Table 2). The percentage of students answering correctly remained consistent between the two iterations for these shared questions, with at least 65% of students performing well on four out of the five MCQs in both problem sets. However, problem #14 in SKI 1.0 (#10 in SKI 2.0), related to static equilibrium involving frictional forces (see Figure 3), showed consistently poor performance, with only 42% correct answers in SKI 1.0 and 40% in SKI 2.0. Despite this, many students rated the problem as "not difficult" and expressed high confidence in their answers, indicating persistent misconceptions about applying forces in static equilibrium. To answer this question correctly, students need a clear understanding of the different types of forces (normal, gravity, friction) and their roles in static equilibrium. The poor performance may be due to the lack of understanding of the direction and the point of action of each force. This MCQ offered limited insight into students' thought processes and did not effectively help us identify gaps in their conceptual knowledge.

Topic: Friction
Problem # 10
Concept Category: Coulomb's Law, Coefficient of friction

Learning Outcome	**Bloom's Index**
Review the basic concepts of friction	Remember [11]

The figure shows a person in static equilibrium leaning against a wall. Which of the following must be true?



(a) There must be a frictional force at the wall but not necessarily at the floor.

(b) There must be a frictional force at the floor but not necessarily at the wall.

(c) There must be frictional forces at both the floor and wall.

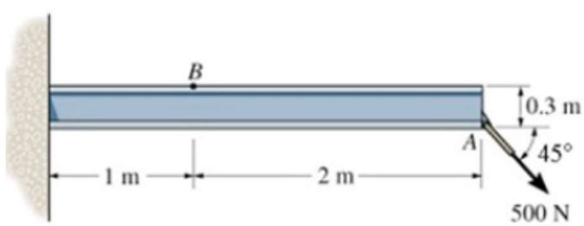
Figure 3: MCQ Problem #10 in SKI 2.0 on static equilibrium with frictional forces [14]

Procedural Problems and Revisions: The SKI 1.0 included seven procedural problems, which we revised for clarity and restructured into scaffolded, multi-part questions in SKI 2.0. Problems such as 5, 7, 9, and 11 were revised to align with Bloom's taxonomy, guiding students through lower to higher cognitive levels in the pyramid. We structured these problems with intermediate steps to help students think in accordance with Bloom's levels, encouraging a progression from foundational understanding to higher-order problem-solving skills while reducing cognitive load. This restructuring provided a clearer framework for solving complex problems, helping students focus on key aspects of the solution process and making it easier to identify and correct misconceptions. To enhance readability, we transformed wordy problems from SKI 1.0 into more straightforward and focused versions. For instance, Problem #9 (see Figure 4), which required calculating the moment and its direction due to a force, was rephrased to emphasize critical components such as vector components, moment arms, and sign conventions. These revisions also simplify the process for instructors to identify and address gaps in students' knowledge.

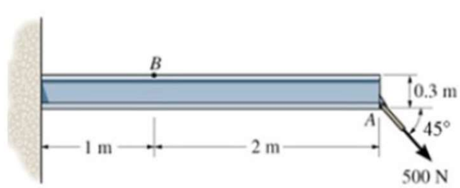
Topic: Moment of a Force and Equivalent Force Systems
Problem #: 11
Concept Category: Moment of a Force and Equivalent Force Systems

Learning Outcome	**Bloom's Index**
Determine the magnitude and direction of a moment due to a force	Recall [31] Carry out [33]

What is the magnitude and the direction (clockwise or counterclockwise) of the moment at point B due to the 500 N force applied at point A?



The Figure below shows a beam fixed to a wall. A force of 500 N is applied at point A.



(i) Calculate the horizontal component of the 500 N force applied at point A.

(ii) Calculate the vertical component of the 500 N force applied at point A.

(iii) Calculate the magnitude of the resultant moment about point B.

(iv) What is the direction of the resultant moment (clockwise or counterclockwise)?

(v) If the beam is symmetric and has a uniform density, will the force of gravity (weight) increase the moment at point B in the same direction?

Figure 4: Example of a Revised Procedural Problem (Problem #11 in SKI 1.0 - Top, Problem #9 in SKI 2.0 - Bottom) [15]

In addition to these revisions, we removed Problem #4 from SKI 1.0. This problem asked students to write vector expressions using polar coordinates but was found to be confusing, as observed in SKI 1.0 results. Removing it also allowed us to maintain a manageable problem set size, ensuring that students could complete the assessment within the allotted one hour during recitation.

VII. Analysis of Sample Problems from SKI 2.0 (Fall 2024)

This section looks at two specific SKI problems to illustrate the key factors covered in the problems: basic physics concepts involved, intended learning outcomes, associated index values from Bloom's taxonomy, and the sequence of concepts in the flow of the problem questions. The two examples from SKI 2.0 are problem #9 (Moment of a Force, Figure 4) and #7 (Equilibrium particles, Figure 5)

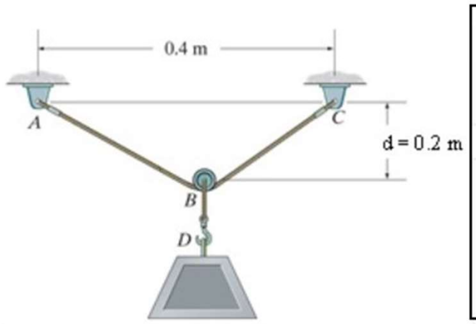
Problem #9, Moment of a Force: This problem involved calculating the moment and its direction due to a force applied to a beam (see Figure 4, bottom). Overall, a significant number of students (97%) struggled with key components of the problem. At least one force component was incorrect or not computed by 27% of the students, and 10% failed to apply the correct sign convention or determine the correct moment arm. The low scores suggest that while scaffolding improved the structure of the problem, gaps in students' foundational understanding of moments persist.

Problem #7, Equilibrium of Particles: This procedural problem (see Figure 5) required students to draw a free-body diagram for a standard 2D static equilibrium setting. While this is a fundamental and required skill in statics that was covered in physics, the performance indicated challenges, with many students making errors in drawing the diagram correctly. About 33% of students in SKI 2.0 drew incorrect free-body diagrams, which significantly impacted their ability to proceed with solving the other parts of the problem. The identified Bloom's indices for the problem are at a higher level in the knowledge dimension and a lower-to-medium level in the cognitive process dimension. With the procedural problems set up this way, we were able to pin-point the specific operations and foundational physics outcomes that would create barriers for students later.

Topic: Equilibrium of Particles
Problem # 7
Concept Category: Equilibrium of particles in 2D, Behavior of Cables, 2D FBD

Learning Outcome	**Bloom's Index**
Idealize a real-life problem as a particle or a system of particles and draw FBDs	Identify [41] Carry out [33], Recall [11]
Solve a 2D problem by applying equations of equilibrium	Carry out [33]

A 50 N block is suspended from pulley B as shown below. Points A and B are supported by pins.



(i) What is the best point (A, B or C) to draw a FBD to solve for the tension in cable ABC, and why?

(ii) Draw the free body diagram at Point B in the given box and name all the forces.
(iii) Write the two equilibrium equations for horizontal and vertical directions at point B using the FBD in part (ii)

(iv) Determine the tension in cable ABC in Newtons [N]. Neglect the size of the pulley.

Figure 5: Procedural Problem #7 in SKI 2.0 [15]

VIII. Overall Student Performance in Procedural Problems in SKI 2.0

Analyzing student performance on procedural problems in SKI 1.0 and SKI 2.0 revealed several key observations. See Table 3 for the summary of results. We included SKI 1.0 results for comparison in the same table. Despite the structural changes implemented in SKI 2.0, which included scaffolding problems into multi-part questions to provide more guidance, overall performance on these problems remained low. The percentage averages for four of the six procedural problems in SKI 2.0 were below 65%, indicating persistent challenges for students in applying fundamental concepts.
Problem #9, as discussed earlier, which focused on moment calculations, highlighted significant difficulties. Similarly, Problem #11, involving static friction concepts, showed the poorest performance, with students often unable to apply static equilibrium conditions effectively.

Table 3: Summary of student performance data in procedural problems in SKI 1.0 and SKI 2.0.

SKI 1.0			SKI 2.0			% improvement
Question # and Topic	Average (%)	Standard Deviation	Question #	Average (%)	STD	
1, Unit conversion	86.8	13.0	1	86.7	13.7	0%
4, Polar coordinates	82.9	31.1	Removed			
5, Vector addition: triangular method	62.9	32.7	4	71.7	17.6	+14%
6, Force vector components & static equilibrium	45.3	42.9	5	57.0	29.0	+25.8%
9, Force vector components & static equilibrium	51.3	17.1	7	64.7	21.5	+26.1%
11, Moment about a point	21.6	25.9	9	64.7	29	+200%
15, Static friction and equilibrium	14.5	8.8	11	34.3	17.8	+137%

Interestingly, procedural problems focused on foundational skills, such as unit conversion (Problem #1) and vector addition (Problem #3), demonstrated stronger student performance in both SKI 1.0 and SKI 2.0. *This contrast underscores the need for targeted instructional support on more complex topics like moments and static equilibrium, as well as a deeper integration of scaffolding techniques to bridge these conceptual gaps.* It is important to note that the overall class average for all problems (both procedural and MCQs) fell below the 65% passing grade for both problem sets, with SKI 1.0 at 50.9% and SKI 2.0 at 65.1%.

IX. Student Confidence and Perceived Difficulty in SKI 2.0:

Figure 6 provides a detailed breakdown of students' self-reported confidence levels and perceived difficulty for each question in SKI 2.0. Of about 26 students who responded (out of 30), most (~74% to 81%) indicated high confidence and low difficulty (~70% to 81%) for foundational problems, such as Problem #1 (unit conversion) and Problems 2 and 3 (vector representation and addition). This aligns with their strong performance on these questions, suggesting that students are aware of their strengths in these areas. Conversely, more complex problems, such as Problems 5, 7, 9, and 11, were rated as "somewhat difficult" or "very difficult" by most students (78.3% to 100%), with corresponding low confidence levels selecting "not confident or somewhat confident" (65.2% to 100%). These ratings are consistent with the lower scores on these procedural problems, indicating students' struggles with topics like vector components and static equilibrium.

Interestingly, Problem #10, an MCQ on static equilibrium involving frictional forces, was rated as "not difficult" by 73.9% of students, with 45.8% expressing high confidence in their answers. However, only 40% of students answered this question correctly, revealing significant misconceptions about the concept. *These findings emphasize that while procedural problems can better expose knowledge gaps, targeted instructional support is needed to address misconceptions and build a deeper conceptual understanding of these challenging topics.*

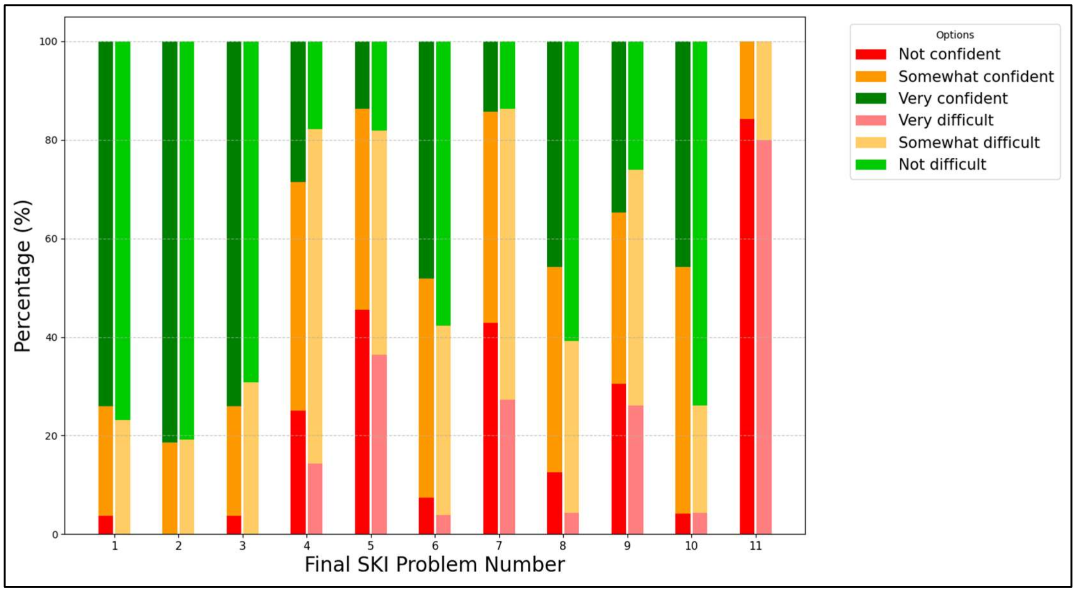


Figure 6: Student confidence and perceived difficulty in all problems in SKI 2.0

X. Summary and Conclusions

The Statics Knowledge Inventory (SKI) is a set of physics problems for assessing physics knowledge transfer at the start of a statics course. The SKI problems were derived using the Learning Map (LMap) method to identify key physics topics and concepts. Common conceptual and procedural problems in Statics were identified, and Bloom's indices were assigned to assess the level of knowledge transfer. The procedural problems were multi-step to scaffold the problem-solving process and identify specific concepts and operations where knowledge breaks down. The provided sample problems illustrate how concepts fit into categories of physics topics, learning outcomes, and associated index values from Bloom's taxonomy.
The analysis of student performance in SKI 1.0 and SKI 2.0 reveals key insights into the effectiveness of the problem sets and areas requiring further improvement. Performance on shared MCQs was consistent across both versions, with at least 65% of students performing well on four of the five shared questions. However, Problems 10 (see figure 3) and 11, related to static equilibrium with frictional forces, consistently showed poor performance, with correct responses dropping to 40% in SKI 2.0. Despite this, students expressed high confidence in their answers, suggesting persistent misconceptions about the topic. This disconnect highlights the need for instructional focus on these concepts.

Revisions to procedural problems in the SKI 2.0, particularly the use of scaffolding, aimed to guide students through intermediate steps to higher levels of Bloom's taxonomy. While these changes improved the clarity and structure of the problems, overall performance remained low. Four out of six procedural problems averaged below 65%, showing continued struggles with these topics. For instance, Problem #7, which required constructing free-body diagrams, revealed significant challenges, with 33% of students producing incorrect diagrams. Problem #9, which focused on calculating moments, showed similar difficulties, as students struggled with vector components, moment arms, and sign conventions despite the added scaffolding.

These findings emphasize the need for targeted instructional strategies. For foundational problems, such as unit conversion and vector addition, students showed stronger performance. However, the persistent gaps in moments and static equilibrium suggest a need for deeper conceptual support, iterative practice, and improved scaffolding. Addressing these challenges will be critical for refining the SKI and enhancing students' understanding of complex engineering concepts.

XI. Future Work

Future work will include continued use and testing of the SKI at the authors' institution to assess knowledge transfer during the Learning Map Project. We plan to share these results and analyses with physics, statics, and dynamics instructors during regular check-ins and workshops. As part of the project, we will seek their feedback to refine and improve future versions of the SKI. With current baseline performance data, we can evaluate student progress after the interventions developed through the LMap project. Additionally, we aim to share this problem set more broadly to continue its development. We recognize that our pilot tests included 19-30 responses, which is too few to apply classical test theory [16] to the conceptual MCQs. We are seeking interest from instructors at other institutions to use SKI 2.0 in their Statics courses with the goal of collecting a larger data set and further refining the questions and associated rubric.

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