Minds on physics answers

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Description of the intent and nature of the minds-on physics curriculum Over the past two decades, after learning, the study has highlighted the shortcomings of high school physics courses: a) The vast majority of students taking high school physics appear only with a shallow understanding of different facts, and (b) What students acquire is usually plagued by misconceptions, many of which persist despite education; and (c) With rare exceptions, students cannot apply what they learn to explain or argue about the world around them, or to solve interesting, non-trivial problems. These unwanted results in physics education result in a discrepancy between the way physics is usually taught and the way students go about business physics. The Physics (MOP) curriculum is specifically designed for this situation. In developing the mop, we have sought to take into account research into the teaching and learning of physics, which has been steadily increasing over the past twenty years. This research has brought to light many of the cognitive difficulties students face in trying to learn physics (see Annex B in the teacher's guide accompanying MOP: Motion). It also demonstrated the value of an active learning environment and cooperative group work to improve student learning and maintain student interest (see additions A and B in the Motion Teacher's Guide). MOP is designed to be consistent with the findings of many different strands of educational and cognitive research – preliminary concepts, expert vs. beginner differences, cognitive load associated with different styles of issues, problem solving vs conceptual understanding, active learning, cooperative group learning, and the impact of meta-communication on the learning process. We believe that MOP provides teachers with an approach to teaching physics that better meets students' learning needs, thereby improving the quality of educational experience for both students and teachers. MOP is an activity-based, full-year curriculum for high school physics. It aims to provide excellent preparation for college-level science and fits well with the National Research Council's National Scientific Education Standards. (For a comparison with 1996 standards, see Motion Teacher's Guide Supplement C.) The MOP activities were designed to help students learn to use physics concepts to analyze and solve problems and curb students' natural tendency to learn rote and engage in formula manipulation. Most activities are great for use in cooperative group settings. Through careful structure and sequencing, MOP activities encourage students(a) to explore the existing understanding of physical concepts, (b) to refine the understanding of formal physics concepts and to study the relationships between related concepts, (c) to analyse and analyse physical concepts and principles for the analysis and causes of physical situations, without encouraging an equation, (d) developing problem-solving skills rooted in an understanding of fundamental concepts and principles and (e) along with seemingly isolated pieces of physics knowledge is a single, meaningful whole. Our goal is to allow students to understand physical concepts more deeply and to be given a greater opportunity to apply them to new situations - or at least steer them in the right direction. Although MOP activities focus on conceptual development, the MOP curriculum should not be regarded as a traditional conceptual-physical curriculum. Many MOP activities require a fairly high level of analytical reasoning and mathematical skills, which are more comparable to traditional problem-solving physical courses than conceptual-physical courses. Similarly, MOP engages students in conceptual reasoning at a much deeper level than is usually the case with conceptual-physics courses – for that matter, any type of high school physics course. MOP is a challenging and rigorous course! Nevertheless, mop is flexible enough to be used by a wide variety of students. For example, MOP activities are replaced by the following: This is possible because it is a sequencing of MOP activities. Subsequent activities help students develop and refine their scientific understanding of physics concepts. Only then will students be asked to carry out more challenging activities requiring complex analytical and reasoning skills. The quantitative/mathematical development of a subject occurs only if students have had sufficient opportunity to develop a thorough conceptual understanding. We believe that MOP can provide all students with the skills they need to succeed in physics and that materials help to create an active and inclusive classroom environment. Another reason many different levels and types of classes can use MOP is that the depth of coverage is determined by the teacher and students, not the activity. It's nice to have issues at the heart of the curriculum. Students at different stages of development necessarily interpret them differently, and their answers always reveal the depth and breadth of their understanding. And teachers can probe as much or little as they desire in students' thought processes. The activities are the heart and soul of the MOP curriculum, but the MOP program is more than just a series of student activities and related materials. It's an approach to learning physics. There are four principles behind this approach: Knowledge is built by all students, not transmitted to them by someone else. Building knowledge is a laborious process that requires considerable time and commitment for the student. Knowledge is often built within the confines of social interaction. Building knowledge impact on the student's existing knowledge. In recognition of these principles, the MOP calls for an action-oriented approach to the learning of physics. This means that the MOP will give a few (if any) lectures to the teacher and require minimal reading from the student before working on an activity. Instead, after a brief introduction to a new topic, students quickly engage in activities that require them to contact other students and the teacher. In working in groups, students use concepts to analyse problematic situations and answer open-end questions, explore the meaning of concepts and practice activities, and share personal reflections from previous experiences. The approach treats students as compassionate individuals, each with a unique way of looking at the situation or solving the problem. The MOP approach builds on what students know and emphasizes processes such as analyzing, reasoning, explaining and strategizing as coverage physics facts. MOP content. The MOP materials are contained in six volumes of student activities and six corresponding teacher guides. The first three volumes of activity are the core of the mop curriculum and can be covered in 1/2-3/4 of the school year. The first volume contains activities that cover Motion. The second volume is Interactions. The third treats Conservation Laws & Concept-based problem solving. Together, these three volumes are called mechanics. The remaining three volumes are additional activities that can be completed by the last 1/4-1/2 of the school year. These are basic forces & fields, complex systems, and advanced themes mechanics. The goal of each is to illustrate how the concepts of mechanics can be applied to many other topics. Materials require very little special or sophisticated equipment. In mechanics, the most manipulative that you may need are common household items, such as balls, string, ebb, balls, and bathroom scales. However, this is useful if teachers have access to basic equipment such as dynamic carriages, air tracks and spring scales. Inside the additional activities, some of the necessary equipment is a little special, but still simple and familiar, such as elements, magnets, wire, and nails. Reviews. Traditional ways to test students do little to explore conceptual difficulties or measure understanding of physical laws and principles. In addition to new approaches to teaching physics, new methods should necessarily be developed to assess the development of learners. New assessments should encourage students to focus on features that are important for deep understanding. In The Teaching Aids for Teachers, we present a number of examples that show how we examine students' conceptual understanding and how to measure their progress with the new approach. Role role The mop approach requires a different role for teachers. Teachers are no longer dispensers of information. A teacher who uses the MOP approach spends less time preparing lectures and more time structuring experiences for students. Indeed, there are two or more verifiable answers to many activity questions, each of which depends on the assumptions students make in answering questions. Thus, the emphasis should be pushed away from the answers and whether they are correct or not and should be placed on intelligent discussion of the issues and whether the answers are in line with the assumptions and arguments used. In this mode, the teacher serves as a helper, counselor, or coach, not as a lecturer, and turns students' attention to ideas that ultimately help them come to a satisfactory conclusion. Materials and support for teachers. We worked with teachers for many years. We are aware of the difficulties teachers face in adopting a new curriculum, especially if it is radically different from what has been used in the past. Realistically, you may have a teacher of two to three years that you are fully familiar with the MOP curriculum and that it is your own. The MOP curriculum has included significant support materials to make the transition easier and easier for teachers to manage. We hope that the MOP will enrich the teaching of physics and help students not only learn more about physics and learn better, but also improve their thinking and learning skills. If we had to choose a word to emphasize, it would be communication. Two-way communication between teachers and students is essential for the success of the educational endeavor. No fixed set of materials can be a complete solution to an educational problem. Only teachers can act flexibly enough to meet all the needs of their pupils and only through open dialogue between teachers and students can they fully define their students' needs and provide students with the feedback they need to participate

constructively in the learning process. Development of minds•The teaching materials of physics were supported by the National Science Foundation (NSF) with support from MDR-9050213 and ESI-9255713. Not Minds * Physics Answers the Call to National Scientific Education Standards When Standards Say... Minds•Answers from physics... Science is for all students. Everyone can study physics. The MOP program presents physics as an exercise in analyzing and solving problems. Learning is an active process. Because students learn in different ways, MOP offers a wide range of activities so that all students can experience success. Teachers should support and support questions as they interact with students. MOP minimizes presentation and maximizes student-student/student Interaction. Teachers should organize the discourse between students in the ideas. MOP activities and discussion are student-driven; students are actively involved in their own learning. The performance data collected should focus on the most important academic content for students. MOP supports the student as the center of learning, such as reasoning skills development. Equal attention should be paid to the opportunity and the evaluation of student performance. MOP activities are a continuous formative assessment of student thinking. The evaluation tasks shall be authentic. MOP mimics professional science. Each student should develop the skills needed for scientific examination. MOP activities promote the individual skills needed for science, including both operational and critical thinking skills. Minds•On Physics has been developed with curriculum reform in mind. The program builds on and expands students' knowledge of the physical world, getting students to think about it and not science in a way that makes sense to them. AttachmentSize MOP vs Standards, Long Version (PDF)60.07 KB Questions and Answers to the Minds•On Physics Curriculum These questions are loosely based on being asked by the Chicago Public Schools Board when considering adopting an MOP curriculum. How does the program or materials line up with the Illinois Learning Standards or the NRC's National Science Education Standards? See a comparison of minds•Physics with national standards NSES (1996). For a more detailed comparison, see the PDF attachment at the bottom of the page. Is there any data on student performance in districts that have been using the program for at least two years? No, but the evaluation team led by Allan Feldman has been used in their beta-field testing summary: When the MOP approach is used with MOP materials as a comprehensive curriculum... students have access to knowledge and skills that enable them to develop professional, concept-based problem-solving skills that are inaccessible to traditional curricula. In addition, students who use MOP regularly showed more attention to the meticulous process of solving physical problems than students who use MOP only occasionally. (Feldman & Kropf, MOP summary, p. 2, 7/23/97) Can you provide us with some relevant background on the educational framework of materials and research that has guided the development of materials? The MOP educational framework is called concept-based problem solving. This approach emphasizes analysis and reasoning over both pure conceptual understanding and pure numerical problem solving. Students spend far less time solving problems, but develop deeper understanding and more robust problem-solving skills. The developers are researchers of physics education, expert-rookie metacognition, and bilingual research. The materials were developed using a cognitive framework based on multiple strands of educational research, including misconceptions, schema acquisition, cognitive overload, and knowledge storage and problem-solving techniques for experts and recruits. See, for example, Supplement B (MOP Motion Teacher's Guide titled Concept-Based Problem Solving: Combining educational research results and practical experience to create a framework for learning physics and effective classroom exercises. A slightly shorter version can be found under the title Analysis-based problem solving: Making analysis and reasoning at the heart of physics education. Can you provide a detailed description of the development process, including the names of the primary developers and the pilot/field testing process, as well as a list of field or pilot test sites? The development process can be divided into three stages: pilot, on-premises testing, and publishing. In 1990 we started a team of four physics education researchers (UMPERG) and four high school teachers with a range of settings and a range of skills and experiences. Teachers reviewed the module activities, comments, corrections and suggestions developed by UMPERG, which were then used to review the modules before they were tested. Teachers tried the modules, gave UMPERG more advice on the materials and allowed UMPERG into their classrooms to see how they were used and talk to students. At the end of the 1992 pilot project, we developed and tested 24 modules covering only about 1/3 of the school year. The accompanying teaching resources were answers with brief explanations of all the questions in the module. The modules were developed on the basis of support from the National Science Foundation MDR-9050213. During the on-premises testing phase (1993-1997), the modules were divided into smaller activities that could be started and completed in the same class. We've also started to develop additional activities to downsize a full year, and we've added a Student Reader to summarize the ideas raised during the activities. Teacher support materials Responses and educational aids for teachers have become as small as preparing for students, the difficulties expected for students and the points suggested for class discussion. We added 30 more teachers in Massachusetts, Tennessee and Louisiana to test the materials, and every 6 weeks we met with local teachers to gather insight and share their experiences. Meetings with teachers in Chattanooga, TN and New Orleans, LA happened less often, but just as informative. At the end of this phase, we tested more than 100 activities. These NSF support ESI-9255713. In the publication phase (1997-2003) (1997-2003) curriculum and an additional curriculum with three volumes out of three volumes. The field-tested activities became the core curriculum, and another 80 activities were developed for the additional curriculum. We have organized and expanded teacher responses and teaching aids into fuller teacher guides, each accompanying activities, and have written Teacher Guides for the three volumes of new activities. The last teacher's guide was published earlier this year. For more detailed information about the actual development process, please refer to our model-based design paradigm in the ASK-IT/A2L Technical Report IV. UMPERG [as in writing by MOP — ed] William Gerace, Jose Mestre, Robert Dufresne, and William Leonard. All four physics PhD's have extensive educational and research experience. They have conducted more than 60 workshops and mini-courses in learning and education, have written numerous articles on educational issues since nearly 200 talks about physics education, and completed more than 70 scientific presentations showing nearly 2,000 school children in the United States and South Africa. (They show that physics manifests itself in everyday situations with common elements.) The experimental sites were in four very different environments. One is an excellent private school WV Massachusetts. The other is a suburban H with a diverse student population. The third is an average urban HS Springfield, MA, with a large, though not predominantly minority student population, and a fourth with a downtown, lower-run, 100% minority, school-of-last-resort students in Hartford, CT. Experimental teachers are also very different. One of the ed.d. the University of Massachusetts, and even co-authored their own education manual for teachers. He is involved in many innovative programs and is always willing to try something new. The second is a traditional teacher, well trained in physics and not very creative teaching. The third is a biology teacher with almost no content knowledge teaching physics, but he is brilliant at creating group activities, however, and we have learned a lot from him about adapting our materials to group work. The fourth is an energetic and well-adapted physics and astronomy teacher. A list of field test teachers can be found in the receipts for any of the Student Activities books. There are 34 in total. Most are located in Massachusetts, but one cadre is located in and around Chattanooga, TN, and another is located in and around New Orleans, LA. How does the programme or materials address the diversity of students? Diversity is not limited to ethnic and cultural diversity. Each student has unique skills, past experiences and approaches, and thus Minds•About physics, we show teachers that there are many ways to succeed and there are many ways to do physics. For example, if a student doesn't have the algebra skills to solve the problem traditionally, we'll show you how to help the student to answer. If a school system doesn't have a big equipment budget, we show them how to think and live and do physics without expensive equipment. If you look at MOP, you will see an emphasis on thinking, analysis, and reasoning, which anyone can be encouraged to do at any age from almost any background. Also, you will see common everyday manipulatives like balls, toy cars, and rubber bands, items that students are familiar with and almost every school system can afford. The MOP is activity-based, which means that the teacher decides the depth and level of coverage. MOP has been used in a number of different contexts, such as the 8th There are also a few students I know who use Complex Systems volume to help them with their Junior Level (University) Statistical Physics class. MOP has been used in schools with large minority student populations in Chattanooga, TN, New Orleans, LA, Springfield, MA, and Hartford, CT, and MOP recently adopted by Grand Rapids, MI. MOP has also been used as bridging programs for under-prepared black university students in South Africa. Have you carried out an external assessment of the substances, according to objective and respectable sources? The evaluation of minds•Physics was conducted by a team of researchers led by Allan Feldman, a research team at the University of Massachusetts School of Education. A summary is available. AttachmentSize MOP Evaluation Executive Summary41.25 KB Content tables of the MOP series books The MOP curriculum consists of four reusable activities and reading books for students (paperback, 8.5 x 11), which together cover a full-year curriculum for high school physics. Each student book has an accompanying teacher's guide (spiral knit, 8.5 x 11). These include advice on the use of the MOP curriculum, answers and teaching aids for all activities in the student book, additional conversations about pedagogical practices, and removable photocopied answer pages for students for the activities. Activities & Reader (ISBN 0-7872-3927-5, 190 pages) How to use this book xi accolades xiii Activities 1 - Foresight 1 2A - Communicating the position of an object (alternative version) 7 3 - Position description 9 4 - Use position graphs 15 5 - Generate position sketches 19 6 - Translation of position graphs and time 23 7 - Description of the displacement 27 8 - Description of speed 31 9 - Use of speed graphs vs. Time 35 10 - Generating sketches speed vs Time 39 11 - Translation Speed vs Time 43 12 - Related Strobe charts plot position vs time and speed vs Time 47 13 - Finding and comparing speeds 53 14 - related graphs position vs time and speed vs time 57 15 - More related graphs position vs time and speed vs time 61 16 - Solving constant speed problems using different methods 65 17 - solving constant speed problems 69 18 - recognizing accelerated movement 73 19 - changes description of speed 75 20 - recognizing graphs acceleration vs. Time 81 21 - Generation of acceleration sketches and time 85 22 - Translation of acceleration graphs and time 87 23 - Calculation of average speed acceleration 89 24 - Related strobe charts for graphs of acceleration and time 93 25 - Related graphs and kinematic functions 97 26 - Kinematic quantities associated with kinematic functions 101 27 - Position, speed and acceleration vs. Compare Graphs Time 105 28 - Compare graphs speed vs time and displacement vs Time 109 29 - Various depictions of Accelerated Motion 111 30 - Graphical Representation of Motion: Reflection and Integration 115 31 - evaluation procedures for solving Kinematika problems 119 32 - implementation procedures for solving Kinematics problems 123 33 - Generating procedures for solving Kinematics problems 127 34 - solving constant acceleration problems 129 35 - summary and structuring of Kinematics Ideas 133 Reader: 1. 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An excerpt from the MOP teacher's guides on how to use MOP effectively This section describes how to get started with MOP. Ideally, a teacher would work through all student activities and read all accompanying materials in the MOP Teacher Guides. This is the only way a teacher can make informed decisions about how best to use MOP materials to meet their educational needs and goals. Our experience, however, is that this ideal is unrealistic for most teachers. Teachers have little disposable time to master the new curriculum, so teachers need to learn on the fly. It can take teachers up to three years to become completely comfortable and familiar with the new curriculum. We hope that the getting to know the mop in order to be as effective and effective as possible. Getting started in the following areas: MOP Curriculum Materials Components of Mop Activity The MOP Reader Content of the Teacher aids comment laboratories, presentations, and hands-on activities on global issues: Designing the school year MOP Creation lesson plan around MOP activity formative and summative evaluation MOP The most out of this section, it is best to make copies of MOP materials practical and refer it as needed. MOP Teaching Materials There are two sets of materials with mop, four booklets for students and a suitable booklet set for teachers. The first three booklets deal with topics of mechanics: Motion, Interactions, and Conservation Laws & Concept-based problem solving. The fourth booklet --- Fields, Complex Systems & Other Advanced Topics --- applies the principles developed in the first three booklets to a wide range of physical phenomena. Each student booklet is divided into two sections: Activities are an integrated set of thoughtful engagements for students, and the Reader organizes and summarises ideas for physical content and aims to read it after completing related activities. Each appropriate teacher's guide includes two parts: answers and teaching assistants for teachers, which advises on how to optimise the effectiveness of activities, as well as brief explanations and comments on all questions about students' activities, as well as answer sheets that can be re-dual and disseminated between pupils as needed. Answer pages are especially recommended for tasks that require a lot of graphics or drawing. The first booklet in the teacher series includes three add-ons: Supplement A: Collaborative Group Techniques provides a short list of ideas for structuring class group activities. Addendum B: Concept-based problem solving provides a more detailed account of the MOP approach. Annex C: Comparison of minds•The physical approach with the NRC's National Scientific Education Standards presents a list of basic standards in the Published National Research Council's Scientific Education Standards and a brief description of how the MOP handles each standard. Components of the MOP activity All MOP activities share the same basic structure: Purpose and expected result. In this section, we share with students specific concepts, principles, and other ideas that are discussed in the activity. This section also tells students what they are expected to do. Prior experience/ Knowledge required. First, we list concepts and principles students need to know or know before they try the activity. Thereafter, if necessary, all background, which is the Main activity. This section contains specific questions and problems that examine students' understanding and prepare them to find meaning from ideas. Reflects. After completing the Main Activity, students re-examine their responses to look for patterns. They are also invited to generally, abstractly and in relation to the situations they have studied. Occasionally, an activity contains an additional component: Integration of ideas. This section is intended to bring together different but related ideas, --- often dealing with separate situations in the activity and analysing --- single, often more complex situation. Although MOP activity has several components, the main activity and reflection are the most important. We recommend that students get to the main activity as quickly as possible and do not get over student preparation. Students may struggle, but most of their difficulties can be solved during the activity. Students may initially feel frustrated, but with some reassilation from the teacher and a little experience to face and combat the inevitable confusion associated with a new start, students become confident and independent learners. However, it's a good idea to help students learn about the structure of MOP activities. This can be done gradually and indirectly by meta-communication with students. For example, occasionally ask students if they have learned what they are expected to learn ---, how they know. Sometimes consider whether students have the knowledge to do the upcoming activity. Test their knowledge by asking them some basic questions. Another good idea is to make sure students understand the instructions given in the main activity. This can be accomplished by stopping the class (after students had a reasonable chance to get started) and asking each student or study group to share with the class how they approach the activity. Ask the class if the approach meets all the requirements specified in the directions. After students finish the activity, invite students to share their perspective on the purpose of the activity. There is no traditional textbook about MOP Reader with MOP. There is a Reader, but this is mostly used to track MOP activities. The goal is for students to begin by working on activities with little or no preparation from the teacher or any other resources. All preparations that may be needed can be found in the necessary parts of the activities prior experience /knowledge. The relevant part of the Reader is designed to read after the student completes the appropriate activity (or series of activities) and is intended to organisation and integration of issues. Students can then use the resources for future tasks. Educational tools provide guidance for reading tasks. The Teacher assists in the response and teaching aids for teachers, so we communicate the philosophy that is not retaliating behind each activity and/or activity. We explain our goals and expectations for each activity and try to give warnings about students' difficulties, misunderstandings, and frequent responses. We also recommend how to interpret different patterns of student responses as well as how you evaluate students' understanding. Educational aids are designed to prepare teachers for the role of coach of learners' learning. Answers with a brief explanation --- are an invaluable resource. At the very least, they allow teachers to see how we think about a situation or problem. A short explanation or comment is always answered. Our goal is to emphasize the process of analyzing each question to be aware of one's assumptions, and has arrived at an answer consistent with these assumptions. Where appropriate, it indicates that the question can be answered differently from different assumptions. We often also indicate how students can answer the question or argue about the situation. Although we respond, we want to emphasize that the focus is always on the students' thought process and never solely on whether the answer is right or wrong. It identifies --- physical concepts that we will address during the activity and briefly describes the expected results. The time required for a task --- estimate the time it takes for the task to complete. Since there are many ways to approach any activity this estimate is very rough. Other factors, such as class ability or path through the material, will affect the time required for the activity. We recommend that you continue to keep the log for the time you actually need. Preparing for students --- identifies what students need to know before they start the activity. Typically, there are only two or three main entries per task. Our intention is to ensure that the majority of students are prepared for a certain threshold. It is clear that knowledge is piling up and that gaps in students' knowledge/skills are inevitable. Only the teacher can assess whether the class as a whole is ready for an activity. We advise not to be unduly shy about our advance. However, be prepared to give students the support they need. Reader--- indicates which parts of the reader students can read after the activity is complete. Students are often asked to perform multiple activities in a row without a reading assignment. Suggestions for use, organization, and so on--- contains a number of information that is particularly important for creating a lesson plan for the task. Create. they are prepared for which parts of the activity to do in class and which parts to do homework. Sometimes there are suggestions for introducing the activity. There are also suggestions for which passages students can do alone, which passages they can do in groups, and which passages can be performed as classes. There are also proposals that include practical materials for the activity. Expected difficulties for students --- teachers about the difficulties students are likely to have in their activity. We're just going to list a few of the --- we think a lot of students share. Of course, there are many more student hard times that are not listed, and some of them may indeed be more common than those listed. It is useful to keep the log of the most common as well. Learner's --- includes a list of questions that can be used to evaluate students' understanding. Questions can be used to measure students' progress in activity and identify areas of concern. Many items can also be used as exam questions. Suggested points in class discussion --- raise some important points in the discussion. Class-wide discussion is a wonderful opportunity for students to listen to other people's opinions and get feedback about their point of view. Providing support to ensure student --- provides some interventions that teachers can try when students get stuck. Note on laboratories, demonstrations and practical activities The MOP approach emphasises the value of building physical representations for physical concepts and principles and integrates this with more formal representations. Consequently, some activities involve the widespread use of practical activities. It is clear that laboratory exercises and demonstrations also serve to improve physical representation, and a good course will also apply these methods. We would like to argue here that the simple, unstructured discovery of physical ideas in quality, practical assyvári serves an important function that typical demonstrations and formal laboratories have failed to perform. Traditional formal labs are usually cookbooks in nature that involve large amounts of data manipulation and analysis, and often culminate in time-consuming laboratory reports. They are often unmotivated from the point of view of students and do not seem to affect the learning of physics. To be sure, there are many skills to learn from good laboratory experience, but directing physical representation is not a common achievement. A number of excellent laboratory materials have already been published and we have decided not to duplicate this effort. In our experience, most teachers have a strong laboratory practices that they use, and almost all laboratories are compatible with MOP. In many classrooms, demonstrations serve as an example of a particular concept or principle, description and explanation provided by the teacher. For a thinking student, however, the demonstration often raises far more questions than it answers, and without the opportunity to investigate these questions, students can have very distorted views on what demonstration means. To make sure, ask your students what they think they observed after a presentation before you tell them what they should have observed. We recommend that presentations use it more widely for students to discover the features needed to understand physical systems and the reasoning used to analyze them. To maximise the effectiveness of the protests, we encourage teachers to use a series of reason-forecasting-explaining activities in which students think about the demonstration apparatus, predict what they think will happen, observe the demonstration and then describe the reasoning behind the projections. (This is sometimes called an interactive presentation.) In our opinion, simple ordinary manipulative, such as bullets, bullets, springs, strings, and toy trucks, should be well integrated into the course. Students should have continuous access to these materials and should often be asked to apply them to present physical ideas and principles in a qualitative way. It's a very difficult task for students. Perhaps the only thing more difficult for students than transforming their ideas into physical reality is explaining what they are trying to accomplish with another person. Therefore, small group or class discussions on practical activities are particularly fruitful in terms of linking linguistic, formal and physical representations. Global problems: Planning the school year with MOP How you implement mop during the school year depends heavily on the educational goals of your class. There are many possible goals, ranging from preparing students to college science courses to exposing students to the widest possible range of physics phenomena. Faced with a particular class, many teachers feel that these two objectives are in conflict and need to compromise. Moreover, because time is limited, all teachers constantly make decisions about how to spend their hours. I would argue that the most important goal is to make students self-conscious and self-motive learners, and that MOP can help you achieve this. Many students are intimidated by physics, they feel inadequate, they do not have physics, and as a result, turn it off. Students spend too much time on the right answer, or worse, the answer to what they think they want. Open discussion of these issues and your expectations will help them focus on the only meaningful outcome, their own learning and development. Obviously, it is important to reward and effort. However, such rewards do not mix students with the impression that all arguments are equivalent and are only a matter of taste. Touching many topics and modern phenomena is a desirable goal. However, such exposure is effective and durable only if students have some solid basis for the basic concepts to which this knowledge can be associated. MOP aims to build a solid foundation. Depending on the individual goals, the mechanics part of the MOP (i.e. the first three booklets) must occupy 1/2-3/4 of the school year. Although MOP activities are numbered, there is no need to proceed in strict order. It is not necessary to carry out all activities or specific activities in their entirety. While there is no single best path to substances, it is best not to invert related activities designed to target different cognitive stages. As shown in the letter from the authors and developed in Annex B: Concept-based Problem Solving, MOP activities deal with the same subject sequenced in cognitive terms. Students are encouraged to (a) explore their current knowledge, (b) refine and combine their physical concepts, (c) enhance their analytical and reasoning skills, (d) develop problem-solving skills, and (e) organize their knowledge into a coherent structure. Only you can decide which activities to use and how much time to spend on each one. Tasks are designed to be a resource, not a recipe. We recommend the following general counsel: Emphasize the need for good communication between students and yourself and the class as a whole. Students who understand what they're being asked to do tend to be more successful. It is necessary to explain to students that it is not only the answer that is important, but also the relationship between their reasoning and their response. Don't let the students get bogged down. Even the best students do not get the desired idea is the first step. It often takes students considerable time to accommodate and learn how to use new ideas. Instead of waiting for each student to demonstrate their proficiness in a particular concept, you'd like to move on, but with the intention of returning to the subject at a later date. Keep course topics integrated with each other. Students often perceive the introductory physics course as a series of independent topics. Rarely do teachers ask students to find their speed or body position when kinematics is over, and Newton's laws apply. Sometimes this tendency to partition is even more common in mathematical themes such as graphs and vectors. Many teachers use graphs extensively while kinematics and never use them again. They create opportunities for students to combine their knowledge and skills. A spiraling, multi-threaded approach is more effective in learning structuring knowledge as a one-way approach. Consider intertwined movement between interactions as a special case of the above points. Kinematics (vectors, algebra, graphs, change rates, etc.) topics are the most difficult for novice students. There is no need to wait for this formal mathematical development before you start developing physical intuition and reasoning skills. The two can be developed in parallel. This has the advantage of making students more interested and motivated, as most students see kinematics as loud boredom. On the other hand, when they see why you might be worried about the speed and position of an object falling into your net strength, you are more motivated to learn kinematics. Create a lesson plan around an MOP activity if you decide to use a MOP task: If possible, spend time on the task. This is the best way to learn about your activity and you will be better placed to make decisions. Read the educational aids to get a general anamminda on the issues discussed during the activity. Select the available hands-on materials. Decide how to introduce the task. Let your students just jump in, or should you ask a probing question in advance, or should you do an interactive tutorial? For example, you can discuss goals and goals with your class, work on the example, or even do part of the activity as a class exercise. Select the parts of the task that you want to complete, which parts to perform in the class, and which parts can be done for homework. Decide how students participate in the activity. Should it be done as a class, in groups, in pairs or individually? What time does the class talk start? Invite students to present their answers to the rest of the class, and if so, how? Consider how you can support students' progress in the activity. Select the points for class discussion and/or questions to look at students' understanding. Look at the explanations and comments that came with the answers to learn how students can respond to different questions and what those answers might mean. Formative and summative reviews mop most reviews used by teachers at the end of the topic and have a summative nature, i.e. they serve to evaluate students' development and add a grade. Rarely are there tests designed to inform students or teachers about the nature of students' difficulties. Evaluations of this second type are called formative, as the results have consequences for later education. Generally, it tends to identify student problems or misunderstandings while still having time to do something to correct the situation. A stresses the need for formative action, as opposed to sumative assessment. We know that conventional test little is done to identify conceptual difficulties or measure knowledge of physical laws and principles. Traditional exam questions tend to be stress answered and numerical and figurative in nature. It is necessary to develop new methods to assess the development of learners in addition to new approaches to teaching. These new assessments should encourage students to focus on the features that are important for deep understanding. Without new assessment methods, students remain largely unwilling to abandon formula approaches. Examples of how new assessments can be structured to understand students' progress and conceptual understanding can be found in the Probing for Student Understanding section of the Responses and Teaching Aids for Teachers section. Another suggestion is to reserve part of an activity for a later evaluation. If students need to prove their abilities, it's important that the assessment element resembles the tasks they rehearse. Finally, we believe that tests and tests should primarily serve pedagogical rather than evaluation functions. Students do not like and resent exams because they feel valued, i.e. their value is determined. Failure impairs their self-confidence and self-esteem. Success in traditional exams does not send a much better message. Successful students believe that the aim is to make progress in the form of degrees rather than intellectual development. Exams can be designed to be informative for students and can serve as valuable educational experiences for students. Students should go beyond active or even engaged students. They have to invest themselves in the entire process of education. They need to develop self-assessment skills and good exams can help them achieve this goal. They often ask students what they attribute to not being successful or the inability to do the problem helps them create self-reflection as the norm. Teaching self-edied and reflective students is an exciting and rewarding experience. If you are a teacher using Minds* on Physics... Are you a teacher who uses minds•About physics? If so, we'd like to hear from you. Please do not hesitate to contact Bill Leonard for any questions, comments, or feedback. Then maybe check out the MOP Errata site as well. Corrections to errors (gasp!) in published MOP books Whether you believe it or not, there are erratic lists of the following books. (TG means Teacher Guide and AR means Activities & Reader, i.e. student activities book.) If you think you've found an error that we're not going to list, please report it to Bill Leonard. We'll add errata pages to the other books if/as the need arises. Student reader, p. R4, middle: The components of the ant's position are not in meters. [EH, 06Jun04] Student reader, p. R9, top: Average speed t = from 5,0s t = = a +10cm/s, not -10cm/s. [AW, 14Jan04] Many thanks to Andrew Wertz of Littlestown HS Littlestown, PA, and Ed Haley of E.C.O.S. Springfield, MA, who found these flaws. Activity 4, 22. 8. 9, 45. Activity 9, p.46, Probing for students to understand, question P3 In parts a) and (c), the units are to cm/s, i.e. P3) (a) Which object (in Part A) achieves the speed of 1 cm/s first? b) When does this happen? (c) Which object achieves the speed of 1 cm/s first? d) When does this happen? Activity 12, 65. In addition, some students may not realize that the speed goes to zero between strobes 4 and 5 (as shown below on the right). Activity 12, 68. Add the third list: • By exaggerating the curvature of the graph between #4 and #5, you can see that the marble is at the 1 m mark immediately after the half point. Activity 13, p. 76, p1 question answer In part a t = 11/2s, X object x = 71/2cm. Activity 14, 79. Question A4 answer, 1. which corresponds to Answer J A6, Activity 1. 15, Activity 86, Activity 16, 91. Fixed bullet 1: Students may have gotten issue B2 wrong. Activity 17, p. 96, question A5 answer Add to the end of 1. Add the end of the bullet 1, that is, after the plane traveled 20km. Activity 19, 107. the average speed is +1 grid/s – or – 1 grid/s, right between 2 and 6. Activity 23, p. 131. Activity 24, 137. accurate calculations to answer questions B2-B4. Activity 25. Activity 27, p. 163 question R2 answer is really only the first half of the answer R2. m.R3 answer is indeed the second half of the answer R2. r4 question answer is indeed the answer R3. m.R5 answer is indeed the answer R4. Many thanks to Lonnie Grimes of Oakmont High School in Roseville, CA, who found almost all of these errors. Activity 37, p. 146. Many thanks to Patrick Diehl of Ashley Hall School in Charleston, S.C., who found this error. Article 36 shall be replaced by the following: Activity 36, p. 217 Answer to question B2 should be: 580m @ 149°. The answer to question B3 is 500m @ 307°. Answer to question B3, 1. Activity 37, p.222, Suggested points class discussion, 2. both the origin and orientation of the coordinate frame must be determined... Activity 38, 227. Before each expression, there must be a minus sign, and the vector length is 4.24 cm. Thus, the x-component of the V can be written either -(4.24cm) cos(45°) or -(4.24cm) sin(45°), and the Y-component V can be written or -(4.24cm) sin(45°) or -(4.24cm) cos(45°). Activity 38, 229. Activity 42, Activity 258, Task 44, Activity 267, Activity 45, Task 280. I miss the answer to question R3. You should read: Objects considered in situations A3, A6, and B3 may accelerate. For the rest, the object has a constant speed. There are no comments for R3. They, the students do not include A3, perhaps because they think the ball does not accelerate to the top of the pitch. Students also have B1, perhaps because the book is acceleing. But the object examined is the table, which does not accelerate. Students don't include B3, perhaps because they think the ball when it touches the wall. At this point in the course, students are not expected to be able to contact with strength and acceleration. Students should be encouraged to determine which subjects definitely have no acceleration. The rest may be considered to be possibly accelerating. The answer to question R4 is missing. This should be the case: (Students indicate all forces that, in addition to the week introduced here, are about forces they have heard of. They then indicate whether the other forces behave like any of the forces deployed here. Activity 45, 281. This should be as follows: If the spring is dilated rather than stretched, then the strings would be angled inwards rather than outwards. In other words, object G would hang to the left from the place where the string is attached to C, and object H would hang to the right, where the string is attached to C. The comment on the answer to question P5 no longer fit. I need to read, Students do not think it is possible that spring to remain compressed objects between G and H. Activity 46, p. 284, (Additional modes) Probing the student Understanding Question P6 issue P4. Question P7 is p5. P8 question is the question P6. Activity 47. Activity 48, 297. friction is still kinetic.) Activity 49, 307. The answer to question A4 begins with gravity. There is a lack of power in the answer to question A4. Force (i.e. column 1) is kinetic friction. Method of determination (column 2) a Multiply the normal force by the kinetic friction factor. The direction is contrary to _m_1 movement. Magnitude and direction (column 3) of (NA). Note: • In fact, we do not know the normal force, so we cannot determine the force of kinetic friction. However, students may think they know the normal force that uses common sense. Activity 49, 308. Here's what to say: At very low speeds, the Force Act is closer to Bv. Activity 51, 324. The F_N_ x-component of F__N must be left-to-left. The answer to question B1 is that part (b) is incorrect. The F_N_ must be an x-F__N component. The answer to question B2, part c, is confusing. The F_g_1, F_N_2, F_T_2 vectors are not part of the response. They are simply the other vectors of the situation that are included because the components are known. The answer to question B2, part d is wrong. The x-component F_g_2 -F__g_2 cos 60° and _y component must _F__g_2 -_F__g_2 60° sin. The word must be removed from the second row of the last ball for the answer to question B2, i.e. even if I note the magnitude of both voltage forces... Activity 54, 350. Kinetic friction, which depends on the relative speed of the objects in contact, and... Activity 55, p. 357. In the table, showing the time intervals during which your speed is constant (part of the fourth half of the answer to question A5), change the value of 4.9s to 4.8, i.e. the third time interval during which the ball rolls at a constant speed is [3.51s, 4.8s]. Activity 56, 370. Activity 58, 384. Activity 58, 386. Add a bullet: • In other words, your speed may be lower than it was before, but it's always bigger than your father's. Activity 58, 387. 59, p. 389. Assign each team 2 questions from the same section, or put a sheet of paper with the number of 2 questions in a bowl and have the teams choose. Explain to students that each student must explain one question and that each student's grade depends in part on how well the other team members are doing. As the teams work, decide what explanation each student gives. When working hours are complete, give students their assignments, which must be performed either during or after class. When classifying explanations, half of each person's contribution and the contribution of the rest of the team are credited as half. In other words, half of each student's grades depends on his individual explanation and the other half depends on the team's explanations. Place it between bullets 2 and 3: • For small classes with only a few teams, first B and A, and then repeat with parts C and E. Add the following title list: • As a class, compare responses and discuss areas of disagreement. Activity 59, 391. then the tension in rope 2 is greater than that of Activity II. 59, 392. Activity 60, p. 402, question R2, part (a) answer Removal of the, ie, the weight is much higher in the car. Many thanks to Lonnie Grimes of Oakmont High School in Roseville, CA, who found almost all of these errors. Activity must be 74. 0.01N, i.e. ... and the area of each box (2N) x (0.005s) = 0.01N... Activity 76, 529. Activity 76, 532. The answer is R1: Full momentum is maintained in the A3 and A6 situations. Initially, it is zero and remains unchanged during the specified time period. The full momentum is maintained approximately to the A1 position, because the pulse delivered to the system by gravity is small during the explosion. At least one element of total momentum remains in the other 5 positions. The x-direction in the plane of the side (i.e. right) shall be horizontal, the direction y shall be vertical and the z-direction shall be perpendicular to the plane of the side (i.e. directly towards you). In situations A2, A4 and A7, the net external force is in the y-direction, so full momentum is maintained in the x- and z-directions. In the A5 position, the net external force has y- and z-components, so the momentum is only retained in the x-direction. The comments r1 are as follows: Students may think that the momentum is not preserved in position A6 because the wheel is slowing down. Students consider only the ball A3, rather than the Earth-ball system. In the A3 situation, students may not ignore the gravitational forces exerted by the sun, moon and planets on the Earth-ball system. Students might not recognize that the full momentum of the Earth-ball system remains the same during movement of the ball. Students only have two directions, i.e. x- and y-directions. In position A5, it is assumed that the bow string is strong on the yz-plane arrow. Students may think that the momentum is not preserved in any direction in the situation A7, because the ball goes in all directions. response to R2: In situations A3 and A6, all forces are internal; the net power of each system is zero. The comments on R2 are as follows: If students don't have the right situations here, they'll probably generalize incorrectly. Students may not realize that in the A3 they are expected to ignore the forces exerted by the sun, the moon and other planets. Students may not realise that the net strength of the wheel in the A6 is zero because it is slowing down. The answer to R3: In situations where momentum is not retained, there are external forces on the defined system. In all cases, the direction of momentum change is the same as that of the net external force. In order to always maintain momentum, it is necessary to choose a system large enough not to have external forces on it. If we involve The Earth in every system and ignore the gravitational forces exerted by the sun, moon and planets, the momentum will remain in all situations. (There are currently no comments for R3.) Activity 83, 58 _F__N_2 _Ffs F__N_1 4. The displacement of the rope is zero. Activity 87, 616. because the work on the car is complete... Activity 87, p. 618, Providing support student progress, 6. Activity 87, 620. Therefore, students are expected to simply use common sense to try to answer this question. Later, the explanation will be that there is a loss of energy in the macroscopic realm of the microscopic realm, which means that the speed must be lower after hitting the spring than before. Activity 87, 620. This should be the following: The work carried out by the friction force on the wagon cannot be calculated or even estimated. Furthermore, knowing its value would have no significance here, because all the macroscopic kinetic energy lost in the wagon becomes microscopic energy of the wagon. In other words, the forces are inside the car, so stay with the car. However, at this point in the course, students are not expected to be able to distinguish between macroscopic and microscopic energy. Many thanks to Lonnie Grimes of Oakmont High School in Roseville, CA, who found almost all of these errors. The following errors in Vol. 4· the first 3 prints. AT / Activities & Reader. If you have a fourth or higher print or higher printing, they have been repaired. Please check the copyright page (page iv) to see which printing or mixture of printing you have. Content, p. v The correct title of the AT·13 activity is relative motion exploration in one and two dimensions. Activity AT·4, 13. The change in speed may be negative and, if it is, the direction of the tangential component of the acceleration is contrary to the direction of movement. And when the speed change is positive, this component points in the direction of movement. Activity AT·8, 30. Activity AT·8, 31. Activity AT·8, 31. The fourth question in part d is: What is the position and speed of the car at t = 0.68s, not t = 2s. Activity AT·11, 44. Activity AT·17, 69. This error occurs twice in question B1 and once in question B2. Activity AT·17, 69. In particular, there aren't enough strings left hanging to make the wheel spin as many times as you need before stopping. The following illustration replaces the diagram accompanying the description. Right-click or click, and then click Open Picture in New Window (or equivalent) to view the full-size version. Print this version with 100% transparency, or 33% instead of the number of students' books. Also note that the teacher's guide on the answer page is the same as the figure below. Finally, in position B, the angle of the slope became shallower to be consistent with the additional changes listed below. Many of the values of that information need to be changed. The initial speed of the wheel is now 1rev/s, and it is slowing down at a speed of 1/4rev/s2. The ball is now a marble and it's rolling up the slope at 4m/s and slowing down at a pace (Changes displayed in bold.) The question in part b) should be worded: Write a phrase on the position of the marble ... (Change displayed in bold.) Activity AT·18, 73. In other words, 29m/s = 65mi/h. Activity AT·21, 86. Part (c) shall contain part (d). The following errors can be found in the first print of Vol. 4•CS / Activities & Reader. If, in the case of a 2. Please check the copyright page (page iv) to see which printing or mixture of printing you have. Activity CS•3, 13. Activity CS•11, 5 #4 0. which means that both pressure and speed are constant.... Activity CS•11, 51. Activity CS•11, 51. Right-click or click, and then click Open Picture in New Window (or equivalent) to view the full-size version. Print this version with 100% transparency, or 33% instead of the number of students' books. (Complex Systems TG's response page already has the corrected number.) Activity CS•12, 53. (Change displayed in bold.) Activity CS•22, 106. Explain it to me. Part b should read: Which state(s) has the lowest temperature? Explain it to me. (Changes displayed in bold.) Activity CS•26, 127. That word should be left out. Instead, the springs should be considered to be zero or very small calm lengths. The need for this change is that when the springs initially relax, the balls attached to them in position B1 usually move left and right, as well as up and down, which is unnecessarily complicated. By keeping the calm length very small, the movement of the balls (the B1) becomes purely transverse, ie up and down. Note that this change affects only the results of B1. Activity CS•30, 151. The question of D4 should start: Will the wave in the form of a lighter spring ... (The type.) Reader/1. R18, table showing the water speed outside the holes The speed list in the last column is incorrect. The correct table is shown below. (Right-click or click, and then select Open Picture in a new window or equivalent to view the full-size version, and then print it at 50% speed in student books.) Reader/1. R19, table showing the water speed outside the holes, and where the water lands The speed list in the third column and the list of persons where the water lands in the last column are incorrect. The correct table is shown below. (Right-click or click, and then select Open Picture in a new window or equivalent to view the full-size version, and then print it at 50% speed in student books.) Many thanks to Prof. Josip Slisko of the Faculty of Physics and Mathematical Sciences at Benemerita Public University in Puebla, Mexico, who found many of these flaws. Errors.