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ABSTRACT
                Noting the lack of definitive information about
teaching thinking skills and how they are implemented throughout the
year or how they are coordinated among subject areas and articulated
along grade levels, this booklet is intended to provide school
districts with a successful plan for developing a comprehensive
thinking program for grades K-12. The introduction to the booklet
outlines six prerequisites for such a program, including a common
vocabulary of thinking for all teachers, distinctions between process
and product with regard to thinking, and an inservice program to
acquaint teachers with the elements of the thinking instruction
model. The first section of the booklet discusses conditions
necessary for thinking--something to think about, something to think
with, some ways in which to think, and something to think for. The
next section then presents a five step model for developing a
thinking program using the existing K-12 curriculum, and discusses
major implications of this model for teaching and learning. The
remaining sections of the booklet offer suggestions for implementing
the model and for evaluating thinking. (HTH)

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FASTBACK

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Teaching the Process of Thinking, K-12

Kenneth R. Chuska

PHI DELTA KAPPA
EDUCATIONAL FOUNDATION

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Chuska has served on task forces for the Association for Supervision and Curriculum Development, the National Institute of Education, and the Pennsylvania Department of Education. His articles have appeared in the University of Pittsburgh LRDC publications and the Pennsylvania Department of Education's *Thinking Newsletter*. His model for developing programs for the gifted has been distributed by the Pennsylvania Department of Education.

Series Editor, Derek L. Burleson

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Teaching the Process of Thinking, K-12

by
Kenneth R. Chuska

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Introduction

We live in a society that appears to value knowing more than thinking. Little attention is paid in teacher education programs to developing strategies for teaching thinking. There is often no common language about thinking for educators to use across subject areas and grade levels. Calls for the teaching of thinking often are perceived as an add-on rather than as an integral part of basic instruction. Teachers complain about a lack of time to teach thinking because of the need to cover what is in the text or curriculum guide. There is also the confusion about what thinking is. The product of thinking (the answer) is often accepted as thinking rather than the processes that were used to arrive at that product. When the products of thinking are emphasized, the processes involved that led to the product tend to be ignored or downplayed.

While most educators would support the goal of providing more instruction in thinking, when inquiries are made about the specifics of teaching thinking skills and how they are implemented throughout the year or how they are coordinated among subject areas and articulated along grade levels, little definitive information is offered.

The purpose of this fastback is to provide school districts with a plan that will address the above problems. A successful plan for developing an articulated thinking program, K-12, must meet the following conditions:

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1. There must be a common vocabulary of thinking for teachers to use across all subject areas and all grade levels.

2. Common denominators in curriculum content must be identified to show commonalities across grade levels and subject areas.

3. Ways of thinking must be delineated in order to give focus to instruction.

4. The plan must be manageable with regard to implementing, monitoring, and evaluating.

5. The plan should make distinctions between process and product in regard to thinking.

6. There must be an inservice program for teachers to acquaint them with the elements of the model and to provide them with a background of other major models of teaching thinking.

The remainder of this fastback will discuss these six conditions for developing a thinking program.

Conditions Necessary for Thinking

There are four conditions needed if thinking is to occur and if the results of that thinking are to be productive. The conditions are that there must be:

1. Something to think *about*.
2. Something to think *with*.
3. Some *ways* in which to think.
4. Something to think *for*.

The discussion of these conditions follows in the order listed; however, any one of the four conditions can serve as the entry point into the thinking process.

Something to Think About

It would be impossible to list all that there is to *think about*. Therefore, the task is to identify common denominators that encompass most of what is taught and learned in any subject area at any grade level and to classify them into a manageable number of categories that will form a common basis for communication among teachers.

The model proposed here uses 14 generic categories to encompass anything that is taught and learned in any content area and at any grade level. They are:

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1. *Action.* Usually lasting through some time and consisting of more than one event.

2. *Event.* An occurrence, usually one of some importance, that takes place during a particular interval of time.

3. *Idea.* Any conception existing in the mind as a result of mental activity.

4. *Issue.* A matter that is in dispute or under discussion, a basis for debate or controversy.

5. *Object.* Anything perceptible by one or more of the senses, something that can be seen or felt; a material thing.

6. *Other Living Thing.* Anything living of a non-human nature.

7. *People.* A body of persons constituting a community, tribe, family, company, race, or nation sharing a common culture, history, religion, or interests.

8. *Person.* An individual human being.

9. *Place.* A particular area of space, which may be large (Soviet Union) or small (your kitchen).

10. *Problem.* Any matter involving uncertainty or difficulty, calling for choices of action that are difficult either for an individual or for a society. Also, a matter for which solutions are inadequate or unknown.

11. *Process.* A systematic series of actions directed to some end. A continuous action, operation, or series of changes taking place in a definite manner. A series of progressive and interdependent steps by which a result is attained.

12. *Situation.* A state of affairs or a combination of circumstances at a given moment.

13. *System.* An ordered and comprehensive assemblage of facts, principles, doctrines, or the like in a particular field of knowledge. A coordinated body of methods or a complex scheme or plan of procedure. An assembly or parts of organs of the same or similar tissues or concerned with the same function. A method or scheme of classification. The structure or organization of society, business, or politics.

14. *Theme.* The subject of discourse, discussion, meditation, or composition.

Something to Think With

If we are going to think *about* something, then we have to have something to think *with*. The things we think with are facts, ideas, our own experience, others' experience, observations, testimony, beliefs, and emotions.

The things we think with involve data of all kinds, which may be found in many sources. Some of them are:

printed materials	models	diagrams
A-V materials	people	simulations
charts/graphs/maps	experiences	pictures
media	realia	demonstrations

Some Ways in Which to Think

Once there is something to think *about* and some background data to think *with*, then we have to consider the *ways* that knowledge and experience gained can be applied or processed. Following is a list of the ways of thinking most commonly identified in the literature about thinking development today.

Comparing	Translating	Using analogies
Classifying	Reorganizing	Imagining
Estimating	Prioritizing	Logical deducing
Summarizing	Setting criteria	Identifying pros/cons
Hypothesizing	Goal setting	Identifying propaganda
Synthesizing	Problem solving	Identifying consequences
Sequencing	Decision making	Observing
Predicting	Justifying	Creating/designing
Evaluating	Making assumptions	Interpreting

Most of these ways of thinking are probably familiar to the reader. No doubt, some of them are being used by teachers in the classroom. But it is the deliberateness of their use and the variety of their use that require more attention by teachers.

Something to Think For

Why do people think? Without something to think *for* (a purpose), there would be no reason to think *about* anything, no need for data to think *with*, and no need for *ways* in which to use our knowledge and experience. Following is a list of what people say are the reasons or purposes *for* thinking.

Resolve a controversy	Complete an assigned task
Clarify values and beliefs	For personal growth
Identify a problem	For group growth
Solve a problem	Avoid or reduce errors
Make better decisions	Synthesize learning
Improve what exists	Set goals
Make future plans	Create something
Evaluate what exists	Critique something
Prove something	Generate ideas
Relieve anxiety or stress	Satisfy an interest

If we know what we are thinking *for*, then we will know what to think *about*, what information we will need to think *with*, and which *ways* of thinking to use for the intended purpose for thinking in the first place.

Entries into the Thinking Processes

As indicated earlier, entry into the thinking processes can be through any one of the four conditions needed for thinking to occur. In one situation, the information may be the first given (think with). It then has to be related to something that is already known (think about). Then decisions have to be made or conclusions reached about what is inherent in the data (think for). Finally, decisions have to be made about how the information will be used to complete the task (ways of thinking).

In a second situation, an issue, event, or idea (think about) may be the first given. In this case information has to be gathered (think with), and thinking elements (ways) chosen in order to complete the task (think for).

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In a third situation, the purpose (think for) may be the starting point. Then the task would be to choose the topics (think about) that are appropriate for the needed result. The needed background data (think with) would then be selected, followed by the selection of the appropriate thinking elements (ways) to achieve the result.

As a final example, a task may be the given — a problem to solve, a comparison to make, something to design (ways to think) about which little is known. Therefore, knowledge and experience that is related would have to be called on (think about) to gather background (think with) in order to accomplish the task (think for).

The next section will integrate these four conditions into a model for infusing a thinking program into the existing K-12 curriculum. The first part will take the reader through the model. The second part will discuss the implementation plan for an individual teacher or department. The third section will propose a model for curriculum committees to use when revising an existing curriculum or when writing a new curriculum.

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A Model for Developing a Thinking Program Using the Existing K-12 Curriculum

The model proposed here integrates the four conditions of thinking discussed in the previous section into a manageable method for infusing a thinking program into the existing curriculum. The five steps of the model involve the identification and selection of:

1. The topic, unit, or chapter to be studied from the text or district curriculum guide.
2. The generic categories inherent in the study of the unit or chapter.
3. The specific content elements from the existing curriculum or text that relate to the generic categories selected.
4. The basic questions that will determine the knowledge outcomes desired.
5. The ways of thinking that will give students practice in applying their knowledge and experience.

The identification phase will be dealt with as the steps of the model are explained. The selection phase will be included in the implementation section.

Step 1: Selecting a Topic, Unit, or Chapter

The first step in implementing the model is to select a topic, unit, or chapter from an existing text or curriculum guide in any content

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area at any grade level. Usually the topics come from such content areas as literature, science, social studies, the humanities, health, and the cultural aspects of a foreign language. However, variations of the model also can be used in such skill areas as reading, computation, spelling, or the use of the dictionary.

For a run-through of how the model is applied, we will use a topic that is familiar to most readers: the U.S. Civil War, 1861-65.

Step 2: Identifying and Selecting the Generic Categories

In order to plan an articulated and coordinated K-12 thinking program, it is necessary to identify common denominators that delineate what there is to *think about*. These common denominators must accomplish two objectives. First, they must be generic enough to include that which is taught and learned in any content area at any grade level. Second, they must provide a common vocabulary that enables teachers in all areas and at all levels to recognize and communicate the commonalities in their content fields.

The 14 generic categories described on page 10 provide the common denominators that meet those two objectives. These generic categories give us something to *think about* from the standpoint of learning subject matter. Also, they open new avenues of communication among teachers. In the case of the Civil War, all or almost all of the generic categories would be inherent in the study of the topic.

Thus the 14 generic categories provide teachers and students with a manageable way to organize what is to be taught and learned; and the transfer of learning among subjects will be enhanced, since the generic categories would be taught in more than one subject area. There also would be greater articulation K-12, since the study of the same categories would be involved in each grade and subject with only the degree of sophistication changing. Each subsequent practice in the study of a generic category should lead to greater independence by the student in learning how to learn.

Step 3: Identifying the Specific Content Elements that Relate to the Generic Categories

The generic categories in Step 2 do not indicate what the specific content will be in studying a unit or chapter, nor do they indicate what might be on the test. Therefore, Step 3 in the model is to identify the specific content elements included in the selected generic categories. For example, if the generic categories you had chosen for studying the Civil War were Places, Objects, Issues, Persons, People, and Events, the list of content specific elements might include the following:

Places	Objects	Issues
Gettysburg	Monitor and	States' rights
Washington, D.C.	Merrimac	Slavery
South Carolina	Confederate flag	
Plantations	Weaponry	
	Uniforms or dress	
	of the period	

People	Persons	Events
Abolitionists	Abraham Lincoln	Lincoln's
Slaves	Robert E. Lee	assassination
Plantation owners	Dred Scott	Emancipation
	Ulysses S. Grant	Proclamation
		Surrender at
		Appomattox

Thus we can see how the generic categories provide a method of organizing the many specific content elements for any topic, unit, or chapter. Learning this method of classification is efficient because of its universality.

Step 4: Identifying and Selecting the Basic Questions

If we are to think *about* something, then we must have a background of information or experience to use to think *with*. Step 4 in the model is to identify the basic questions to be answered during the study of

the unit or chapter. It is a premise of the model that there are basic questions that can be used to study anything that falls into the same generic category. Such questions are mainly knowledge oriented. Finding the answers to them is necessary for students to have something to *think with*.

The teacher can select the basic questions important to the study of both the generic category and the specific content of a particular unit or chapter, or the teacher can have the class generate its own list of questions at the beginning of a unit of study by asking: What do you know? What do you want to know? What do you feel or believe about the topic of study?

Below are examples of basic questions for two of the 14 generic categories: Events and Problems. They were gathered from teachers who participated in workshops conducted by the author over several years. They are illustrative of the kinds of basic questions that are applicable to any of the generic categories as well as to specific content elements that fall under a generic category.

Generic Category: Event

What is its history?
What and who were involved?
Who was affected?
What was involved in planning?
What were its objectives, purposes, or causes?
What were its anticipated outcomes or consequences?
What preparation was needed?
What is its relationship to you, your family, your community?
When did it occur?
Where did it occur?
How long did it last?
What reactions did it cause?
What other event was it like?
What changes could be made to improve it?
What were its costs?
Could it happen again?
What factors could affect the success of the event?

Generic Category: Problem

Why is it a problem?
To whom is it a problem?
What are some probable causes?
Who or what is involved?
How serious is it?
Why is it necessary to solve the problem?
Can the problem be solved, resolved, or just reduced?
Who or what is necessary to solve or reduce the problem?
What is your reaction to the problem?
What are the pros and cons of each position?
What have been some similar problems in the past?
How have similar problems been solved in the past?
Who has the final say in regard to the solution of the problem?
How could similar problems be prevented in the future?
What resources are needed to solve the problem?
How are people currently coping with the problem?
Is there a process for solving this type of problem?
Is there a time limit for solving the problem?

By using the basic questions that apply to the generic categories and related specific content elements, students begin to understand that anything that falls into a generic category can be studied in the same way; thus, they learn how to learn. The same list of questions can be used time after time and year after year. And those questions selected from the list over a period of a year should be varied in order to make students aware of the different approaches to the study of a category or anything that falls within it. Naturally, the selection and wording of the questions and the number used would have to be adjusted for the age level involved.

Step 5: Identifying and Selecting the Ways of Thinking

With a background of knowledge and experience to *think with*, the student must then become familar with the variety of *ways* of thinking that are available. Step 5 in the model is to select one or more

of the ways of thinking listed on page 11 that will be appropriate for the instructional purpose.

Using all 27 of these ways of thinking listed on page 11 may appear unwieldy and impossible to implement in the time available for instruction. Therefore, it is helpful to condense the list to five major categories, each of which is briefly described below.

1. *Creative or Inventive.* Practice in this type of thinking enables students to generate or produce unique or original ideas, processes, and products. Synthesis is a major method in this category.

2. *Logical.* Practice in this type of thinking enables students to follow sequential steps in thinking, to justify if-then relationships, and to use deductive reasoning in solving a problem.

3. *Experimental or Investigative.* Practice in this type of thinking enables students to test hypotheses, to use survey methods to learn about issues and opinions, and to learn about the use of control of variables in scientific investigations.

4. *Analytical or Critical.* Practice in this type of thinking enables students to engage in whole-to-part and part-to-whole thinking, to practice inquiry methods used in the social studies and science, and to be more discriminating in making decisions.

5. *Reflective.* Practice in this type of thinking enables students to discipline themselves to delay decision making until sufficient data is at hand or alternatives are explored.

These five categories of thinking incorporate most of the elements of thinking programs reported in the literature. The task of teachers is to provide deliberate practice in using as many of the ways of thinking as possible. Using the Civil War again as an example, the chart below shows how the model might be implemented.

Examples of the Process of Selecting Thinking Elements

Generic Category	Specific Content	Ways of Thinking
Issue	State's Rights	Summarize the positions of the North and the South.

People	Plantation Owners (South) Industrialists (North)	Analyze the needs of owners of these institutions to make a profit. Compare the status of slaves and factory workers in regard to working conditions.
Event	Emancipation Proclamation	Interpret the ramifications of this for the South/North.

Something to Think For

The five-step model outlined here is incomplete without some consideration of what the purposes for engaging in thinking should be, that is, something to think for. The purposes for thinking are listed on page 12. It will be helpful for teachers to refer to this list to answer the following questions about purposes for thinking:

1. Given the specific content of the text or teacher's lesson plan, what kinds of thinking practice can be provided?
2. What opportunities for what type of thinking are inherent in the study of the specific content?
3. What purposes can be identified for practice in using various ways of thinking as the specific content is being studied?

Major Implications of This Model for Teaching and Learning

1. Students will learn that there are 14 generic categories that encompass any content that is taught or learned. Learning how to categorize specific content into the generic categories will enable them to make their learning more manageable.

2. While students are engaged in learning the specifics of the curriculum, they also are learning how to learn about anything that falls into the category of those specifics.

3. Students will become aware that there are basic questions that apply to both specific content and their generic category. Through practice with the variety of questions, the students will learn that there are several approaches to studying anything.

4. Students will become aware of the relationships between and among subject areas, since the model calls for the generic categories to be emphasized in all content areas. They will see that the same basic questions can be used in any content area that is emphasizing that category.

5. Students will become aware that there are many ways of thinking. Since the various ways of thinking will be used in all content areas, students receive practice in them in a variety of academic settings. This practice will enhance their recognition of the transferability of ways of thinking between and among content areas.

6. Teachers, regardless of grade level or content area, will have a common vocabulary with regard to generic categories, basic questions, and a variety of ways of thinking. These factors will open communication among all teachers. They, too, will see the interrela..onships between and among their roles and their content areas.

7. Implementing this model should have a cumulative effect enabling students to become independent learners.

The next section outlines a plan by which an individual teacher, a department, or a curriculum committee can implement the model.

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Implementing the Model

It is recommended that the five-step model be implemented in only a few curriculum areas at a time. New areas should be added gradually over a three-year period until the model is used throughout the curriculum. It is not feasible to use the model in all curriculum areas at the outset; but once teachers gain experience in applying the five steps to one unit, say in the social studies or science, they will find that adding new units in other content areas takes far less time and becomes easier to do.

The description of the model in this fastback provides enough direction for committed teachers to begin using it on their own. However, it would be far better if teachers had an intensive inservice program where they could practice applying the model before using it in the classroom. The sharing and peer critique that goes on in well-planned inservice sessions will give teachers confidence in undertaking this systematic approach to teaching thinking.

Also, sample units developed in the inservice program can be shared among teachers, thus speeding up the implementation schedule. Of course, when an entire school district decides to implement the model for the K-12 curriculum, it is essential that an inservice program be held for all teachers with regular follow-up sessions.

For an elementary teacher who teaches all subjects in a self-contained classroom, the three-year implementation plan might begin by 1) choosing one topic, unit, or chapter in social studies;

2) identifying the generic categories inherent in the study and selecting two for emphasis; 3) selecting the list of basic questions to be used; 4) identifying the specific content that applies to the two generic categories; 5) identifying the purposes for having the students learn the specific content; 6) select the ways of thinking that will accomplish the purposes.

Once the teacher has gained experience with one unit in one content area (social studies), then the same process can be used for units in language arts, science, and health. With at least three units in each curriculum area covered in the first year, then the second and third years can be devoted to adding new units in each area. Thus, at the end of three years an emphasis on thinking will pervade the entire curriculum. Students will be able to approach any topic in terms of generic categories, will be able to use basic questions to learn specific content, and will use a variety of ways of thinking that are appropriate for the purposes established.

For a secondary teacher who teaches in only one subject area, the steps would be the same as those outlined above for the elementary teachers. Actually, the process should be easier because the teacher is working in only one content area. Nevertheless, the author still recommends that a teacher apply the model with every third topic, unit, or chapter. With the experience gained from the first round, by the end of three years all units of the course can have a thinking emphasis.

The best opportunity for developing an articulated and coordinated thinking program is when a curriculum committee revises a course or develops a new course. As the curriculum is being written, the committee might identify only two generic categories to be emphasized in each unit of work, but would ensure that all generic categories were covered every year. The committee also might make specific suggestions about which ways of thinking should be practiced to achieve the objectives of the unit at each grade level. It is important that the committee ensure some balance so that a variety of ways of thinking are practiced every year.

The teacher implementing the curriculum would have the responsibility of determining the basic questions to be used with each generic

category according to the sophistication of the students, and of providing practice in those ways of thinking that are appropriate for the instructional purposes. The administrator would be responsible for providing the inservice program and for monitoring the implementation of the new curriculum.

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Evaluating Thinking

In this fastback the focus has been on practice in the ways of thinking (the processes involved) rather than on thinking skills (the proficiency a person demonstrates in using the processes). This distinction is important when it comes to evaluating a thinking program. Evaluating thinking skills requires measures of the level of sophistication or degree of complexity a person exhibits in the use of thinking processes and measures of the degree of creativity or originality a person exhibits in the use of those processes.

There are tests of thinking skills on the market for creative thinking (Torrance), reasoning (New Jersey), critical thinking (Watson-Glaser, Pittsburgh Schools), and others. However, it is the author's belief that the methods of evaluating thinking are in their infancy, much as is brain research on how we learn. It is his position that the individual teacher who has had training and experience in teaching thinking is in the best position to evaluate students' level of thinking and growth in thinking. A teacher who works with students on a daily basis for nine months in a curriculum that is infused with thinking processes has the ability to evaluate thinking skill growth.

The first task in the evaluation process is to identify the student's current level of operation with a given way of thinking. The first month of school should be used to engage students in thinking tasks in order to establish baseline information. The teacher then can construct ac-

tivities throughout the year to provide practice in those ways of thinking and to assess students' progress. The following example illustrates how a teacher can get an initial assessment of one of the ways of thinking — making comparisons. The teacher asks the student to compare two of something. Depending on the student's response, the teacher might rate the student's skill as:

Low Level   Student completes the assignment using a minimum number of points for the comparison.

High Level   Student uses multiple points for comparison (fluency). Student uses a variety of points for comparison (flexibility). Student uses fine details in making the comparison.

Higher Level   In addition to the above, the student uses points of comparison not usually associated together. Student makes comparison in a manner that is unusual for a student of that age level; that is, it is more typical of a more mature student.

Highest Level   Student's comparison is different or unusual from others in the peer group or from previous groups in the teacher's experience (uniqueness/originality). Student's comparison is made in a manner that not only is different but causes a "wow!" experience for the teacher or peers (creativity).

Another method of evaluating thinking ability is the use of a checklist with such items as the following:

- Backs up statements with data and valid reasoning.
- Recognizes when information is missing that is needed to solve a problem.
- Produces ideas or raises questions that are unusual for students of that age group.
- Shows concern for problems of a broad societal nature.
- Lays out a plan for thinking about how to think about an assigned task rather than going directly for a solution.

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- Recognizes the degree to which personal beliefs, values, and biases affect making decisions.
- Demonstrates the ability for compromise.
- Shows ability for self-evaluation.
- Uses analogies to explain new learnings.
- Produces products that demonstrate good organization.
- Has many ideas that are accepted by others.
- Shows a willingness to examine both sides of the issue.
- Uses a wide range of resources in arriving at conclusions or solutions.
- Defers judgment until further study is completed.
- Shows curiosity about what is behind the surface of something.
- Can set up criteria for evaluating a given.
- Sees relationships among things.

This list is intended only as a starter. Teachers will no doubt add other items to the checklist as they gain experience in integrating thinking into their instruction.

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The Challenge

The approach advocated in this fastback for incorporating thinking processes into the existing curriculum represents a feasible plan that can be implemented by an individual teacher, the faculty of a single school, or an entire school system.

The five-step model presented here can serve as a blueprint for any curriculum area. The challenge now is to implement an articulated K-12 thinking program. This will require planning, monitoring, evaluation, and an ongoing inservice program. But most of all, it will require the dedication of teachers committed to making thinking processes the core of the curriculum.

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