DOI: 10.4312/elope.11.1.137-150

ELOPE

Melita Kukovec
University of Maribor
Slovenia

Cross-Curricular Teaching: The Case of Mark Haddon's *The Curious Incident of the Dog in the Night-Time*

Summary

The knowledge learners acquire at school has to be applicable in practice to ensure their motivation for learning. Both cross-curricular and interdisciplinary teaching provide a meaningful way in which students can use the knowledge acquired in one context as the basis for learning in other contexts in and out of school. By using interdisciplinary teaching, the instructor can present the topics in a holistic manner: this approach therefore allows us to activate more of the learners' senses and intelligences. Since Mathematics is one of the least liked subjects by our students, and English one of the favorite ones, the article will demonstrate how we can integrate activities addressing all types of intelligences in a language learning class to achieve the whole range of Bloom's levels of educational objectives on the basis of a novel which includes a wealth of references to mathematics: *The Curious Incident of the Dog in the Night-Time* by Mark Haddon, which has recently been compulsory reading in all Slovene grammar school programs.

Key words: cross-curricular/interdisciplinary teaching, educational objectives, multiple intelligences, Mark Haddon

Medpredmetno poučevanje z obravnavo romana Marka Haddona *The Curious Incident of the Dog in the Night-Time*

Povzetek

Da bi zagotovili potrebno motivacijo za učenje, mora biti znanje, ki ga učenci pridobivajo v šoli, uporabno v vsakdanjem življenju. Tako medpredmetno kot interdisciplinarno poučevanje omogočata uporabo znanja, pridobljenega v nekem kontekstu, kot osnovo za učenje na drugih področjih, v šoli in izven nje. S pomočjo interdisciplinarnega pristopa lahko teme celovito predstavimo in s tem aktiviramo več učenčevih čutil ter mnogotere inteligentnosti. Ker je matematika pri naših učencih manj priljubljen predmet, angleščina pa med bolj priljubljenimi, bomo v prispevku predstavili, kako lahko pri pouku tujega jezika ob obravnavi romana Marka Haddona z naslovom *Skrivnostni primer ali kdo je umoril psa,* ki ponuja izjemno veliko primerov in zanimivih razlag matematičnih problemov, z uporabo dejavnosti, ki razvijajo mnogotere inteligentnosti, dosežemo celo paleto izobraževalnih ciljev.

Ključne besede: medpredmetno/interdisciplinarno poučevanje, izobraževalni cilji, mnogotere inteligentnosti, Mark Haddon

Cross-Curricular Teaching: The Case of Mark Haddon's *The Curious Incident of the Dog in the Night-Time*

1. Introduction

The present article first defines interdisciplinary teaching by describing some of its characteristics, advantages and potential shortcomings, since the renewed school curricula place a special emphasis on cross-curricular links and there has been some discussion of how this could be done. Secondly, since English is one of the more popular subjects and Mathematics one of the least favorite subjects in Slovene schools (Damjan, Vidovič and Vodeb 2012), we wanted to find a common element to help us demonstrate how the integration of activities addressing the development of multiple intelligences can be used to intertwine Mathematics and English in order to achieve the whole range of Bloom's levels of educational objectives which serve as a quality control mechanism. To achieve this aim, an example is provided on the basis of a work of art, an English novel by the title of *The Curious Incident of the Dog in the Night-Time* by Mark Haddon, which includes a wealth of references to Mathematics and has recently been compulsory reading in our grammar school programs.

2. What is Interdisciplinary or Cross-Curricular Teaching?

Interdisciplinary teaching is a method, or set of methods, used to teach a unit across different curricular disciplines or subjects. Sometimes called cross-curricular teaching, it involves a conscious effort to apply knowledge, principles, and/or values to more than one academic discipline simultaneously. According to Jacobs (1989, 27), the disciplines may be related through a central theme, issue, problem, process, topic or experience: "The organizational structure of interdisciplinary/cross-curricular teaching is called a theme, thematic unit, or unit, which presents a framework with goals or outcomes that specify what students are expected to learn as a result of the experiences and lessons that are a part of the unit". There are two possible levels of integration that schools go through: the first one is integration of language skills like listening, speaking, reading, writing, and thinking; the second one refers to a much broader kind of integration, one in which a theme begins to encompass all curricular areas (Pappas et al. 1990, 10). The arts challenge pupils to consider complex issues and think in different ways, which makes them use different forms of intelligence and helps them examine their thoughts, feelings and actions. While students are learning the basic information in core subjects, they are not usually applying their knowledge effectively in thinking and reasoning; interdisciplinary teaching therefore provides a meaningful way in which students can use the knowledge acquired in one context as a basis for other contexts at school and out of it.

The terms cross-curricular and interdisciplinary teaching are sometimes used interchangeably and will be treated as such for the purpose of this study, since English in itself comprises various disciplines such as linguistics, literature, and the underlying cultural aspect, but on closer inspection there is a small difference between them. According to (ibid., 14) cross-curricular teaching is an approach where teachers attempt to present a specific content or issue in a comprehensive way so that they illustrate it from different aspects which are all a part of different school subjects. In Slovenia this kind of teaching has been introduced in the first years of the nine-year primary schools. Teachers across the country have found many productive ways of integrating work in a

new language with the rest of the primary school curriculum, while reinforcing work in other subjects at the same time. However, research on first grade teachers shows that the understanding of the concept of cross-curricular teaching is poor. It is therefore believed that the issue deserves more attention in the education of present and future teachers as well as in research.

Interdisciplinary means involving two or more disciplines. Davis (1995, 5-6), and others have necessarily expanded on this definition and noted important differences among the terms interdisciplinary, multidisciplinary, and cross-disciplinary: "One of the key distinctions between interdisciplinary and multidisciplinary is that interdisciplinary refers to an integrative process or relationship, while multidisciplinary is only additive. Cross-disciplinary, on the other hand, refers to viewing one discipline from the perspective of another" (ibid., 5). Davis takes integration as the key characteristic of interdisciplinary courses, with "scholars working together to pool their interests, insights, and methods, usually with the hope of gaining and presenting new understandings that could not be derived from working alone" (ibid., 6).

He also examines the origins of disciplinary specialization and its impact on traditional teaching. The limits of disciplinary specialization and the need for multiple perspectives and more coherence in the curriculum are presented as the basis for turning to interdisciplinary, team-taught courses as an alternative. For teachers the required components are the need for integrative skills, awareness of multiple perspectives, the ability to work collaboratively, and the capacity to cope with complexity.

While Davis presents an in-depth case for interdisciplinary courses, the following list of potential advantages of interdisciplinary teaching and learning is, according to Leora Baron from the Academy for the Art of Teaching, Florida International University (2002), a handy summary of the rationale given by Davis and others: "it is reflective of life, which is not segmented into discrete disciplines; it allows for the use of multiple approaches and applications of skills for problem solving; it can provide a broader context for new information; it allows for a broad use of diverse experiences and knowledge bases; it encourages creativity and creative thinking; it allows for greater flexibility, teaching improvement through joint planning and mutual observations; it provides for a heightened level of collegial communication; it opens up possibilities for an expansion of course offerings with minimal or no additional resources; it can provide expanded opportunities for the application of theory, it provides a good introduction and foundation for various disciplines and the use of diverse perspectives; it helps develop tolerance of ambiguity, it can enhance the ability to synthesize and integrate information; and last but not least important, it can integrate the new information environment that tends to be less linear and more cross-disciplinary."(Baron 2002, 369)

3. Types of Interdisciplinary Teaching

There are many different types, or levels, of interdisciplinary teaching. At one end, schools might employ an *interdisciplinary team approach*, in which teachers of different content areas are assigned to one group of students and are encouraged to correlate some of their teaching (Vars 1991). In Slovenia this approach is used in special grammar school programs called European Classes or Evropski razredi. The most common method of implementing integrated, interdisciplinary instruction is the *thematic unit*, in which a common theme is studied in more than one content area (Barton and Smith 2000, 54), as in our first years of the primary school with *multidisciplinary or parallel design*, which is defined as lessons or units developed across many disciplines with a common organizing topic (Jackson and Davis 2000, 43).

One of the foremost scholars of interdisciplinary teaching techniques is James Beane, who

advocates *curriculum integration*, which involves a curriculum that is collaboratively designed around important issues (e.g., Graz International Bilingual School). It has four major components: the integration of experiences, social integration, the integration of knowledge, and integration as curriculum design. It differs from other types of interdisciplinary teaching in that it begins with a central theme that emerges from the questions or social concerns of students, without regard to subject delineations (Beane 1997, 61).

Both, interdisciplinary and cross-curricular teaching offer the opportunity to combine work by more than one teacher. Davis (1995, 8) suggests that professors teaching alone can make interdisciplinary connections; on the other hand, his emphasis is on courses involving two or more professors collaborating in significant ways. *Team teaching* can be organized in the following ways: with a single instructor covering multiple disciplines, by team teaching of separate courses, by team teaching of linked courses or by team teaching of one integrated course.

4. Benefits and Shortcomings of Interdisciplinary/Cross-Curricular Teaching

Interdisciplinary/cross-curricular teaching is often seen as a way to address some of the recurring problems in education, such as fragmentation and isolated skill instruction. It is seen as a way to support goals such as transfer of learning, teaching students to think and reason, and providing a curriculum more relevant to students (Marzano 1998; Perkins 1991). By using a cross-curricular approach to teaching and learning, schools can encourage and challenge pupils to think creatively.

According to the National Assessment of Educational Progress (Applebee et al. 1989, 27), while students are learning the basic information in core subject areas, they are not learning to apply their knowledge effectively in thinking and reasoning. Interdisciplinary or cross-curricular teaching provides a meaningful way in which students can use knowledge learned in one context as a knowledge base in other contexts in and out of school (Collins et al. 1989).

Many of the important concepts, strategies, and skills taught in the language arts are readily "portable" or transferable (Perkins 1986) to other content areas. The concept of perseverance, for example, may be found in literature and science. Strategies for monitoring comprehension can be directed to reading material in any content area. Cause-and-effect relationships exist in literature, science, and social studies. Interdisciplinary and cross-curricular teaching support and promote this transfer. Critical thinking can be applied in any discipline.

Flowers et al. (1999) identify five important findings of their experiences with interdisciplinary teaching and planning: common planning time is vital; schools that team have a more positive work climate; parental contact is more frequent; teachers report increased job satisfaction, and student achievement scores in schools that team are higher than in those that do not team.

In a year-long pilot program, a school district in Michigan created integration plans for thematic units, based on the ideas of Howard Gardner about multiple intelligences. The results of the program included "sustained enthusiasm" from the staff, parents, and students, increased attendance rates, and improvement in standardized test scores, "especially from students with the poorest test results" (Bolak et al. 2005).

Moreover, interdisciplinary/cross-curricular teaching can increase students' motivation for learning and their level of engagement. In contrast to learning skills in isolation, when students participate

in interdisciplinary experiences they see the value of what they are learning and become more actively engaged (Resnick 1989, 33).

Interdisciplinary/cross-curricular teaching also provides the conditions under which effective learning occurs. Students learn more when they use language arts skills to explore what they are learning, write about what they are learning, and interact with their classmates, teachers, and members of the community (Thaiss 1989, 6).

Additionally, Pumerantz and Galanto (1972, 9) find that interdisciplinary teaching allows for students to "proceed at a pace commensurate with their interests, skills, and experiences". Integrated instruction helps teachers better utilize instructional time and look deeper into subjects through a variety of content-specific lenses. Another benefit of integrated instruction is that teachers can better differentiate instruction to individual student needs. Integrated instruction also allows for authentic assessment (Barton and Smith 2000). A final benefit of interdisciplinary teaching is that students have a chance to work with multiple sources of information, thus ensuring they are receiving a more inclusive perspective than they would from consulting only one textbook (Wood 1997, 201).

There are also potential shortcomings with this approach. Thematic units can fall short of teaching in-depth content to students. Often a certain theme is used to link unrelated subjects, with little deference to students' prior knowledge or interests. This superficial coverage of a topic can give students the wrong idea about school, perhaps missing the idea of curriculum integration in the first place (Barton and Smith 2000). Thematic units can contain pointless busywork and activities created solely to create a link to a theme; for example, the alphabetizing of state capitals in a social studies unit, in an attempt to integrate it with language arts (Brophy and Alleman 1991). Team-taught interdisciplinary lessons also require more time during the process of lesson planning. Owing to differences in attitudes and beliefs of the teachers, some conflicts are to be expected; on the other hand, these could be perceived as opportunities for the formation of new professional views and acquisition of new knowledge.

Since the teacher is no longer *the sage on the stage* but *the guide on the side*, new approaches to learning and teaching are based on active learning or learning by doing, learner centeredness, collaborative learning, team work and team teaching, individualized instruction including multiple intelligences, learning to learn and authentic materials. Taking this into consideration we would like to advocate interdisciplinary teaching as an effective way of achieving higher educational goals and bringing together subjects which at the first glance do not have much in common: e.g., a social studies subject like a foreign language and a natural sciences subject like Mathematics.

5. English versus Mathematics in Interaction with Multiple Intelligences

Some school subjects are more popular than others and some more readily awake natural interest in learning. According to the findings of Klara Štraus, the writer of a study on cross-curricular teaching of English and Mathematics, the current style of teaching mathematics cannot create interest in natural sciences in learners who are not yet motivated, nor does it encourage them to experiment or seek information on their own (Štraus 2008). The problem of not understanding and not liking Mathematics is related to the differing perceptions of individual learners and differently developed centers for single intelligences. There are fewer problems in learning English, since learners are more engaged and more motivated, and usually benefit from more attractive or

interesting teaching techniques. So a question arose of whether it were possible to make learners absorb mathematical content more effectively with a combination or integration of subjects or simply through the subject of English, which they like more. She came to the conclusion that by taking multiple intelligences and the benefits of cross curricular teaching into consideration, one could create a new approach for teaching mathematics (ibid., 31). Although this can be an overstatement, the fact remains that by teaching in an interdisciplinary manner we encourage students to use the knowledge acquired in one context (i.e. school subject) as a knowledge base in another context and provide for more collaborative learning, more learner-centredness and learning by doing. Therefore, if the students enjoy reading about a fictional character's approach to solving mathematical problems in English and this helps them understand the issues better, the teachers of both subjects (like our double major students of English and Mathematics) can actually replace less efficient teaching approaches in one subject with more efficient ones from another.

Learners who enjoy math lessons are a minority in our schools. These learners dominantly use logical-mathematical intelligence, as one of the 8 intelligences at their disposal. Alongside the linguistic one, this intelligence is most highly appreciated in the civilized world, as it enables us to use numerous inventions and operate machines, so it can be applied in many jobs. The ease by which all normal people and numerous ones with lower capabilities master their mother tongue despite its intricacy shows that the entire human race is additionally equipped for the development of abilities in the area responsible for the linguistic intelligence. Some problems that most people have in order to make inferences before learning show that we are not additionally prepared in other areas, so it is possible that some nerve centers are easier to relax, stimulate, program, or slow down, while others are hard to activate or obstruct (Gardner 1995). That we are not additionally prepared in this area is not a sufficient reason for giving up on Mathematics as a subject. Research has shown that individuals with hemispheric brain damage in the mathematical-logical center were able to solve the same tasks as "healthy people". The only difference was that they resorted to other aids or methods: either visual, linguistic or a combination of more methods. Based on the findings of neurological research, we can come to an important conclusion: when one of the intelligences is poorly developed, we can always use other intelligences to achieve the same goal.

During English lessons, **verbal** intelligence is used almost all the time. Since we are better prepared or we have better dispositions in this area, there are consequently fewer problems. **Interpersonal** intelligence is activated through relationships between the teacher and learner/s or learner and learner/s. **Spatial** intelligence is activated mostly visually by many drawings or images in the textbooks or other aids. With **musical** intelligence, learners distinguish many different types of intonation, minimal pairs in pronunciation or observe the speed of spoken language. Motion and therefore **bodily-kinesthetic** intelligence is used when learners perform actions. Other intelligences are present according to the content and specific topics – **naturalist** intelligence can be awakened during a debate about animals, the **intrapersonal** one by writing an essay. **Logical-mathematical** intelligence is present every time the rules must be obeyed. Rules mainly refer to grammar, and this area is the one that causes most problems. Gardner's explanation of which centers are better developed in general is the answer to grammar problems. This could also be why Mathematics causes so many problems for the learners – there is the need to use mainly mathematical-logical intelligence throughout the lesson.

Gardner's idea of developing intelligences in the classroom is appealing to teachers who are willing to explore learners' knowledge and perceptions, and who shape their teaching styles into a form that suits individual students. In this way students can develop the intelligences at which they excel to the maximum, on the one hand, and improve their weak points, on the other. Verbal

intelligence is also of great importance to the subject of Mathematics, since some aspects and exact manners of expression depend on this intelligence. However, the problems with verbal intelligence occur when it interferes with the rational part of the subject. It is expected that students will be able not just to tell us something about the mathematical topic, but also to show that that they understand the content. "Students typically fail as soon as the problem is expressed in a slightly different way or an unexpected example is encountered or described" (Gardner 1993, 173).

Let us use Gardner's example for demonstrating a case where verbal intelligence presents an obstacle to logical thinking: when we have a number of professors and tell learners that there are six times as many students as professors, everyone can calculate the missing quantity. When we give the number of students and the same ratio, the result is also good. But when we ask them to verbalize this or write out the formula for this task, where the letter S stands for students and the letter P for professors, the majority of (college) students fail. This may seem as an easy task, but most people would write the formula as 6S=P. The problem here is the fact that the word six occurs near the word students and therefore they "fall into the 6S trap".[1]

In the previous situation the difficulty was putting ideas into words, but in other mathematical situations there are plenty of words available to express our thoughts or results. At this point a problem arises because of the required precise manner of expression, which leaves no room for improvisation. In a normal conversation we are free to add humor and use the lexicon in many ways, but mathematics allows for no such imprecision.

Sometimes verbal intelligence is the key distractor in mathematical processes, and sometimes it can be a savior. Some learners are not able to sum two numbers, but when these numbers are described as prices for two products, and only when currency is added, the learners get the whole picture of the problem and are able to get the results. This is frequent with very young learners who are able to do mental calculations but not able to connect the two realms. Through interdisciplinary lessons with an emphasis on the use of intelligences, we can pay attention to the learner's use of strategies and can redirect them to the use of intelligences that are more appropriate for certain types of tasks.

A survey of the current national curricula in primary and secondary schools reveals no explicit cross-curricular connection between English and Mathematics. According to students, however, English has a privileged position as a subject. The language is used to address different topics or themes which empower or establish various cross-curricular links; the activities used to do this can address more than one intelligence as well as different educational goals. Students can express their opinions, likes, dislikes, and preferences; they can also have more influence on the choice of topics or ways of expressing themselves, and often there is more than just one correct or acceptable solution or answer, which all contributes to an increase in motivation.

Mathematics is a subject of rational thinking that leaves no place for emotions. But without emotions like excitement or the feeling of satisfaction, there is no personal need for discovery in this subject. Motivation is needed in general for everything we do; therefore, it is even more urgent with subjects that demand mathematical-logical intelligence, since according to Gardner (1993), the predispositions for the use of this type of intelligence are lower than for linguistic intelligence. Motivation through emotions supported by intrapersonal intelligence and empathizing with others through interpersonal intelligence are among the most neglected types of motivation in the teaching of mathematics.

We can therefore suggest the integration of these two different fields as an interesting solution

[1] The correct formula is Nt = 1/6 Ns or 6Nt=Ns

to this problem. A work of art, such as a novel, seems to be an ideal starting point or a common denominator, particularly if the story includes descriptions and explanations of numerous mathematical problems, such as in Mark Haddon's *The Curious Incident of the Dog in the Night-time*, which was recently compulsory reading for the Matura exam in our grammar schools. An additional dimension lies in the fact that the main character is a child with special needs who uses typically autistic language, which offers ample opportunities for creating links with various disciplines.

If we use a new approach, we also need a quality-control mechanism. Interdisciplinary teaching can be effectively based on the development of multiple intelligences; at the same time, we should ensure that this approach brings student knowledge to the required level of complexity. Bloom's levels of cognitive complexity can serve as ideal quality controllers.

According to Bloom, thinking processes can be measured by determining the levels of cognitive complexity apparent in interpretations of complex situations. The cognitive domain involves knowledge and the development of intellectual skills. This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills. The taxonomy of educational objectives that is often called Bloom's taxonomy is a classification of different skills and learning objectives. There are six major categories, which can be thought of as degrees of difficulty. Thus, learning at the higher levels is dependent on having attained prerequisite knowledge and skills at lower levels (Orlich et al. 2004, 129), or the lower level skills must be mastered before the next ones can take place. Since the focus of teaching is on all three domains – affective, psychomotor and cognitive, Bloom's taxonomy also motivates teachers to create a more holistic form of education.

Since cognitive psychology is the predominant paradigm in education, it has almost become more important to see *how* students think than *what* they think. The eight intelligences are cognitive capacities, as they refer to memory and problem solving; therefore, Bloom's levels of cognitive complexity also apply to them. Since linguistic and logical-mathematical intelligence are more emphasized in our schools, we believe that, in order to improve students' strong points in other intelligences, we have to teach in a way that activates as many intelligences as possible to achieve all levels of cognitive complexity.

Bloom's levels of cognitive complexity rank from knowledge, comprehension, analysis, application, and synthesis to evaluation. Below, teachers can find an aid in the form of a list of verbs and indicative questions related to each particular level which they might find helpful when creating tasks or activities for any of the levels of educational objectives.

Knowledge refers to rote memory skills, knowing facts, terms, procedures or classification systems. Words and questions that are typically used to check knowledge are these:

Words	Questions
choose, define, find, label, list, match, name, recall, recognize, remember, show, spell, select, tell,	what is...? who.. ?, where…?, when...?, when/how did … happen?, how would you explain … ?, how would you describe…?, can you recall…?, how would you show ..?, can you select..? who were the main ..?, can you list three ...?

Comprehension refers to understanding the meaning, the ability to translate, paraphrase, interpolate, and interpret instructions and problems or to stating a problem in one's own words. Words and questions that are typically used to check comprehension are these:

Words	Questions
classify, compare, contrast, demonstrate, describe, explain the main idea, illustrate, infer, outline, put in your own words, relate, rephrase, summarize, show.	how would you classify/ compare/ contrast/ rephrase...?, which statement supports…?, what can you say about..?...

Application is the capacity to transfer knowledge from one setting to another, to use a concept in a new situation or an unprompted use of an abstraction. Words and questions that ask a student to apply previously learned information to get an answer are these:

Words	Questions
apply, build, classify, choose, employ, develop, identify, interview, make use of, model, organize, plan, select, solve, use, write an example.	how many examples…?, which other way..?, what elements would you change..?, what would happen if..?, can you organize…to show...?

Analysis means examining and breaking information into parts by identifying motives or causes, discovering and differentiating the component parts of a larger whole and finding evidence to support generalizations. In analysis questions, students are asked to engage in three kinds of cognitive processes: to identify the motives, reasons, and/or causes for a specific occurrence, consider and analyze available information to reach a conclusion, inference, or generalization based on this information. Unless students can be brought to the higher levels of analysis, synthesis, and evaluation, it is unlikely that transfer will take place. If teachers do not ask higher level questions, it is unlikely that most students will transfer school work to real life. They may not even be able to apply it to school situations other than the one in which it was "learned." Words and questions that are typically used to check the ability of analysis are these:

Words	Questions
analyze, categorize, classify, discover, dissect, distinguish, divide, draw conclusions, determine the evidence, examine, identify motives or causes, inspect, simplify, support, survey	how would you classify...?, why do you think..?, how is this related to…?, what evidence can you find..?, explain why…, what conclusions can you draw..?...

Synthesis requires higher order questions that ask the student to perform original and creative thinking. Synthesis questions ask students to produce original communications, make predictions, and solve problems. Although analysis questions may also ask students to solve problems, synthesis questions differ because they do not require a single correct answer, but allow a variety of creative answers instead. Words and questions that are typically used to check the ability of synthesizing are the following:

Words	Questions
adapt, build, change, combine, compile, construct, delete, design, develop, elaborate, estimate, formulate, imagine, invent, minimize, maximize, make up, originate, plan, predict, propose, produce, solve, suppose, synthesize, theorize, test, write,	how can we improve…?, what would happen if..?, can you think of an original way of..?, how can we solve..?, what changes would you make to solve..?, can you predict an outcome?, how would you adapt…to create a different..?

According to Armstrong (2000, 130) **evaluation** is judging the value or utility of information using a set of standards or making judgments about the value of ideas or materials. It is achieved by higher level questions that do not have a single correct answer. It requires the student to judge the

merit of an idea, a solution to a problem, or a work of art. The student may also be asked to offer an opinion on an issue. To answer evaluation questions objective criteria or personal values must be applied and some standard must be used. This type of questions is frequently used to surface values or to cause students to realize that not everyone sees things the same way. They can be also used to start a class discussion (for example: Do you agree with...?) or even precede a follow-up analysis or synthesis question like "Why…?" Words typically used in evaluation questions are these:

Words	Questions
award, agree, appraise, assess, choose, compare, conclude, criticize, decide, deduct, defend, determine, disprove, dispute, estimate, evaluate, explain, influence, interpret, judge, justify, measure, mark, perceive, prioritize, prove, rate, recommend, rule on, select opinion, support, value	do you agree with the actions/with the outcomes…?, what is your opinion of …?, how would you prove/disprove…?, can you assess the value or importance of…?, would it be better if ..?, what would you recommend..?, how would you rate/ evaluate/ prioritize..?, what would you cite to defend the actions …?, what data was used to make the conclusion ..?

In an attempt to present an effective example of cross-curricular teaching based on the development of multiple intelligences we used a work of art in the form of a novel by Mark Haddon which enabled us to integrate two distinctly different subjects like English and Mathematics, representing respectively verbal or linguistic and logical-mathematical intelligence. We will suggest the tasks and activities that foster the development of multiple intelligences and at the same time, by using the quality control mechanism of Bloom's taxonomy, enable students to achieve all levels of cognitive complexity. The tasks were piloted by our students during their teaching practice.

6. The Curious Incident of the Dog in the Night-Time

We can easily find eight tasks that activate individual intelligences or six tasks that follow the principles of Bloom's taxonomy of learning objectives in reference to the novel *The Curious Incident of the Dog in the Night-Time.* The book is beautifully written, thought provoking, and empathy-inspiring; the hero, a convincing narrator, is a savant, a young boy with Asperger's syndrome, who knows all the countries in the world and their capital cities and every prime number up to 7,057. He has a photographic memory, is incapable of telling lies, and prefers animals to most people; he thus feels at a loss in the real world, which is full of ambiguity and replete with idiomatic use of words, and he feels safe in his world of numbers, order and his own unique system of interpretation of complex mathematical problems. His writing is dominated by numbers in all kinds of situations, but it also provides clear explanations and ample visual back-up in the form of charts, drawings, plans, remarks, examples, and clarifications. The plot offers many cross disciplinary links and the book has proven to be well liked by secondary school students.

The interaction of intelligences and Bloom's levels, on the other hand, demands 48 tasks that cover individual combinations; nevertheless, the suggested list is not conclusive. Following is a set of activities or tasks the teachers can use in preparing their students for the examination if they aim at developing various learning styles, intelligences and at the same time address different subjects like English and Mathematics or even beyond that, several different disciplines. The order of tasks is determined by the level of difficulty or cognitive complexity from knowledge to evaluation.

Linguistic intelligence

At the level of	An example activity
knowledge	*Remember names of characters and places.*
comprehension	*Explain why Chris left his father.*
application	*Given the descriptions of different public places, explain what an autistic person would do in a given location .*
analysis	*Describe how Chris functions in individual institutions of society.*
synthesis	*Write an essay about the life of an autistic person.*
evaluation	*Rate responses of individuals towards Chris's unusual behavior.*

Logical-mathematical intelligence

At the level of	An example activity
knowledge	*Remember prime numbers up to 50.*
comprehension	*If every letter has its number of value (1-25), search for the names the sum of which gives prime numbers.*
application	*Given the map of England, estimate what distance Chris travelled in km – is it a prime number?*
analysis	*Divide mathematical problems into 2 groups: logical problems versus calculation tasks.*
synthesis	*Given the Monty Hall problem, use any method to solve it.*
evaluation	*Rank Christopher's mathematical problems from the easiest to the toughest one.*

Spatial intelligence

At the level of	An example activity
knowledge	*Remember Christopher's drawing, name the colors Christopher dislikes.*
comprehension	*Given the graphic presentation for quick multiplication, calculate the square of 25.*
application	*Visualize Chris's hometown and London on a map; in which direction is London from his home?*
analysis	*Analyze Christopher's way of finding the station (making circles close to the station).*
synthesis	*Draw Christopher's street using the colors and persons that he likes*
evaluation	*Rate his perception of the environment (photographic memory).*

Bodily-kinesthetic intelligence

At the level of	An example activity
knowledge	*Recognize the shape of a cylinder while holding it in your hands.*
comprehension	*Find as many cylindrical objects as possible in your surroundings.*
application	*Make a cylinder by using different materials.*
analysis	*Research how many equal components can make a cylinder.*
synthesis	*Gather materials and tools to make a cylinder that sticks together without glue and has an empty space inside.*
evaluation	*Explain what makes Christopher's cylinder different from yours.*

Musical intelligence

At the level of	An example activity
knowledge	*List some sounds and noises from the story.*
comprehension	*Explain what kind of sounds can make Chris nervous.*

application	*Listen to different kinds of mood music and find out how each of them makes you feel.*
analysis	*Link different kinds of mood music to Chris' emotional states through the story.*
synthesis	*Create your own song based on information from this text.*
evaluation	*Rate the mentioned songs from best to worst and give reasons for your choices.*

Interpersonal intelligence

At the level of	**An example activity**
knowledge	*Record responses to the question: "What do you like about Chris?" (Class interview).*
comprehension	*Determine Chris's most likeable characteristic according to your interview findings.*
application	*Use the results in a discussion to find famous persons with the same or similar qualities.*
analysis	*Classify school-mates into groups according to which characteristics they like.*
synthesis	*Create a mind map of different professions and decide which characteristics are required.*
evaluation	*Rate the characteristics according to your own opinion.*

Intrapersonal intelligence

At the level of	**An example activity**
knowledge	*Remember the time you first came across a mathematical problem.*
comprehension	*Share the feeling you had while trying to solve it.*
application	*Develop a technique for solving problems according to your experience.*
analysis	*Divide your experience into beginning, middle and end part.*
synthesis	*Compare Christopher's problem solving with your experience.*
evaluation	*Rate responses of individuals towards Chris' unusual behavior. Explain what you liked and what you disliked about his behavior.*

Naturalist intelligence

At the level of	**An example activity**
knowledge	*Name all the elements of nature in the story (plants and animals).*
comprehension	*Explain how people should treat animals.*
application	*Create a list of animals that can be pets to humans and a list of animals that are devoted to their masters.*
analysis	*Explain why the rat (Toby) ran away at the train station.*
synthesis	*Write a paper about the connections among nature, animals and humans.*
evaluation	*Comment on Christopher's attitude towards nature.*

7. Conclusion

The knowledge learners acquire at school must be applicable in practice to ensure their motivation for learning. Interdisciplinary teaching provides a meaningful way for students to use the knowledge acquired in one context as the basis for learning in other contexts in and out of school. By using interdisciplinary or cross-curricular teaching, instructors can present a wide range of topics holistically; this approach therefore activates more of the learners' senses and different intelligences. The interdisciplinary connection of Mathematics and English in interaction with multiple intelligences can effectively be done using a selection of the above-listed activities for teaching the novel *The Curious Incident of a Dog in the Night Time* by Mark Haddon, which was perceived as a kind of project work, where a single instructor covers multiple disciplines.

The suggested model of activities for each of the intelligences is an attempt to show that, through careful selection and inclusion of various tasks, the teacher can achieve not only the basic but also the most demanding levels of cognitive complexity, which are often neglected in more superficial every day teaching. The list of key words and potential questions for the development of individual intelligences can serve as a guideline for the creation of similar tasks and activities and can be applied to almost any topic or subject.

The student teachers who tried some of these activities in practice confirm that using an interdisciplinary approach gives students an opportunity to apply, integrate and transfer previously acquired knowledge, which at the same time are the main features of cross- curricular teaching, and since the tasks rank from lower levels of cognitive complexity to the highest, motivation is increased and, consequently, the quality of learning is improved.

References

Applebee, Arthur N., Judith A. Langer, and Ina V. S. Mullis. 1989. *Crossroads in American education: A summary of findings: Educational Testing Service*. Princeton, NJ.

Armstrong, Thomas. 2000. *Multiple intelligences in the classroom*. Alexandria (Virginia): ASCD Association for Supervision and Curriculum Development.

Baron, Leora. 2002. "The Art of Teaching." *Journal of Engineering Education* 91: 369.

Barton, Keith C. and Lynne A. Smith. 2000. "Themes or motifs? Aiming for coherence through interdisciplinary outlines." *The Reading Teacher* 54 (1): 54-63.

Beane, James A. 1997. *Curriculum Integration*. Teachers College Press: New York.

Bloom, Benjamin, ed. 1956. *Taxonomy of educational objectives: the classification of educational goals*. Handbook 1: Cognitive Domain. New York: David McKay Comp. Inc.

Bolak, Karen, Donna Bialach, and Maureen Dunphy. 2005. "Standards-based, thematic units integrate the arts and energize students and teachers." *Middle School Journal* 31(2): 57 - 60.

Brophy, Jere, and Jennet Alleman. 1991. "A caveat: Curriculum integration isn't always a good idea." *Educational Leadership* 49 (2): 66.

Collins, Allan, John Seely Brown, and Susan E. Newman. 1989. "Cognitive apprenticeship: Teaching the crafts of reading, writing and mathematics." In *Knowledge, learning and instruction: Essays in honor of Robert Glaser*, edited by Lauren Resnick, 453-494. Hillsdale: Erlbaum.

Davis, James R. 1995. *Interdisciplinary Courses and Team Teaching: New Arrangements for Learning*. Phoenix: American Council on Education and Oryx Press.

Damjan, Janez, Darja Vidovič, and Dušan Vodeb. 2012. "Odnos dijakov do najljubšega predmeta v šoli." *Priljubljenost šolskih predmetov*. Projekt unisVET. Ministrstvo za vzgojo in izobraževanje. Accessed March 20, 2014.

http://www.suaslj.com/unisvet/posveti_in_usposabljanja/2012-03-22_23.htm

Flowers, Nancy, Steven B. Mertens, and Peter F. Mulhall. 1999. "The impact of teaming: Five research-based outcomes." *Middle School Journal* 36 (5): 9-19.

Gardner, Howard. 1995. "Reflections on Multiple Intelligences: myths and messages." *Phi Delta Kappa* 77 (3): 200-208.

– – –. 1993. *The Unschooled Mind: how children think and how schools should teach*. London: Fontana Press.

Haddon, Mark. 2004. *The Curious Incident of the Dog in the Night-Time*. London: Vintage.

Hodnik Čadež, Tatjana, and Tjaša Filipčič. 2005. "Medpredmetno povezovanje v prvem razredu osnovne šole." *Pedagoška obzorja* 20: 3-4.

Jackson, Anthony W., Gayle Andrews Davis, Maud Abeel, Anne Bordaro, and Anthony Jackson. 2000. *Turning Points 2000: Educating adolescents in the 21st century*. New York: Teachers College Press.

Jacobs, Heidi Hayes. 1991. "Planning for curriculum integration." *Educational Leadership* 49 (2): 27-28.

Marzano, Robert J., Debra Pickering, and Daisy E. Arrerondo. 1998. *Dimensions of Learning*. Alexandria, Virginia: ASCD.

Orlich, Donald C., Robert J. Harder, Richard C. Callahan, Michael S. Trevisan, and Abbie Brown. 2004. *Teaching strategies: A guide to effective instruction* (7th ed.). Boston, MA: Houghton Mifflin.

Pappas, Christine C., Barbara Z. Kiefer, and Linda S. Levstik. 1990. *An Integrated language perspective in the elementary school: Theory into action.* New York: Longman.

Perkins, David N. 1991. "Educating for insight." *Educational Leadership* 49 (2): 4-8.

– – –. 1986. Knowledge by design. Hillsdale, NJ: Lawrence Erlbaum Inc.

Pumerantz, Philip, and Ralph W. Galano. 1972. *Establishing interdisciplinary programs in the middle school.* West Nyack, N.Y.: Parker Publishing Company, Inc.

Resnick, Lauren A., and Leopold E. Klopfer, eds. 1989. *Toward the Thinking Curriculum: Current Cognitive Research*. ASCD Yearbook. Washington DC: ASCD.

"Interdisciplinary Teaching Increases Student Learning." Starting Point: Teaching and Learning Economics. Science Education Resource Center at Carleton College. Accessed March 2, 2014. http://serc.carleton.edu/econ/interdisciplinary/why.html

Štraus, Klara. 2008. Medpredmetno povezovanje angleščine in matematike s pomočjo romana *The Curious Incident of a Dog in the Night Time*. Unpublished diploma paper. Maribor: Faculty of Arts.

Thaiss, Christopher J. 1989. *Language Across the Curriculum in the Elementary Grades.* Urbana, Illinois: ERIC Clearinghouse on Reading and Communication Skills and the National Council of Teachers of English.

Vars, Gordon F. 1991. "Integrated curriculum in historical perspective." *Educational Leadership* 49 (2): 14-15.

Wood, Karlyn E. 1997. *Interdisciplinary instruction: A practical guide for elementary and middle school teachers*. Upper Saddle River, N.J.: Merril.

Zavod RS za šolstvo. 1998. "Angleščina: predmetni katalog – učni načrt." Ministrstvo za šolstvo in šport. Accessed March 10, 2014. http://portal.mss.edus.si/msswww/programi2006/programi/gimnazija/gimnazija/ang.html#3.

– – –. 1998. "Matematika: Predmetni katalog – učni načrt" Ministrstvo za šolstvo in šport. Accessed March 10, 2014. http://portal.mss.edus.si/msswww/programi2006/programi/gimnazija/gimnazija/matemati.html.