CHAPTER 2

Managing the Reins of Inquiry: The Role of the Teacher in IBL

Abstract The Future Problem Solving (FPS) Program is used as a case study that explores the ways in which a teacher/coach contributes to the effective inquiry-based education of a student. A high degree of expertise on the part of the teacher/coach is essential for successful inquiry-based learning to take place in the classroom. The inquiry literate teacher/coach facilitates the development of the students' inquiry literacy through three process phases (the exploratory, the evidence gathering and the sense making), whilst undertaking seven distinct teaching/coaching roles (direct instructor, facilitate interpretation, discussion facilitator, mentor, organiser, questioner and logistics organiser). The role of Information Communication Technology on the teacher role of data selection is explored.

Keywords Future Problem Solving (FPS) program · Role of eacher/coach · Inquiry literacy · Information Communication Technologies (ICTs) · Locus of control · Classroom learning environment · Field learning environment

1 Misconceptions

The use of the term inquiry-based learning (**IBL**) to describe this particular form of curriculum and pedagogical approach tends to have the effect of de-emphasising the fact and reality that IBL has its corollary in 'inquiry-based **teaching**'. This impression is reinforced in the research

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literature, which highlights a plethora of research evidence relating to the positive impacts of inquiry learning by students (Assay and Orgill 2010; Walker and Shore 2015), but a relative lack of similar studies on the role of the teacher in inquiry education. Whether this deficiency is a cause of, or a reflection of, common teacher perception about the nature of IBL is a moot point, but the anecdotal evidence suggests that misconceptions about the nature of IBL and the role of teacher within that process tend to be encapsulated in simplistic terms and contexts. These generalisations tend to revolve around anecdotal beliefs that IBL is simply a matter of students working independently, and that the role of the teacher is merely to avoid methods of direct instruction. IBL is the 'easy' choice that benefits the teacher, because once they have explained the task, it is up to the students to complete it with a minimum of input from the teacher. The role of a teacher is, according to the trope, limited more to behaviour management than teaching the skill of inquiry. The contention here, which follows on from the discussion in Chap. 1, is that the reality is far more challenging, and that far from being an easy choice, IBL requires a high degree of expertise on the part of the teacher. For successful IBL to take place, teachers themselves must first become 'inquiry literate' and then provide opportunities for students to engage in inquiry at a personal, individual level.

The focus of this chapter is, therefore, to explore and reconfigure the ways in which a teacher can contribute to the effective education of students through inquiry-based **teaching**. In particular, it examines the multiple roles and concerns with which a teacher is involved in the process of engendering IBL. In that context, it is appropriate to commence with an example of an IBL programme that is very clear in its explanations and attitudes towards the role of the adult educator.

2 A Case Study: The Role of the Teacher in the Future Problem Solving Program

Future Problem Solving Program International (FPSPI) is a global, independent, not-for-profit organisation that 'stimulates critical and creative thinking skills, encourages students to develop a vision for the future and prepares students for leadership roles' (Future Problem Solving Program International 2017b). Originally developed in the mid-1970s as a vehicle for gifted students by E. Paul Torrance, a contemporary leader in this field of education, it now caters for students throughout the years of primary and secondary schooling, involving students annually from many different affiliates, including Australia, China, Hong Kong, India, Japan, Korea, Malaysia, New Zealand, Portugal, Singapore, Turkey, United Kingdom and a number of the constituent States of the USA (Future Problem Solving Program International 2017a). In its globalised form, it can be viewed as an International Education Program (IEP), since it takes the form of a '…structured [package] of educational instruction that [is] school-based, but operat[ing] independently of, and alongside, the daily school classroom curriculum…' (Casinader 2014, p. 52).

FPS Program is composed of several learning or participation options for students, who tend to be registered through their schools, and therefore are usually (but not always) supervised by a teacher from their school. Sometimes, parents supplement the school's staffing resources. All of these learning options are based on the six-step FPS thinking and analytical process (see Fig. 1), which is itself derived from techniques in Creative Problem Solving (CPS) (Casinader 1995, 1999, 2014; Crabbe 1989; Volk 2003). In effect, each option is '… curriculum that is being delivered to students by adult educators…' (Casinader 2014, p. 55). It is this six-step process, and the way in which students participate in the different learning pathways that employ it, that characterises FPS as an IBL program.

Although there are individual options available, primarily in the areas of short story writing (Scenario Writing) and short story telling (Scenario Performance), the two current major learning options offered maintain the original priority for students to work in groups or teams. In the Global Issues Problem Solving (GIPS) option, students are grouped into teams of four, although 'squads' of up to six are often used. In Community Problem Solving (CmPS), in which the focus is on developing a long-term solution to an existing community issue, student groups can range from two students upwards, although the usual convention has been to remain below 15 students. Whole class group teams of 15–25 do exist, but are much rarer.

The role of the teacher in the FPS IBL framework is very clearly defined. In documentation about the undertaking of the Program and its learning options, the adult is clearly identified as a 'coach' (see, for example, Future Problem Solving Program Australia 2008; Future Problem Solving Program International (FPSPI) 2016b). Given the fact that FPSPI is of American origin and has functioned as such for most of its existence—it

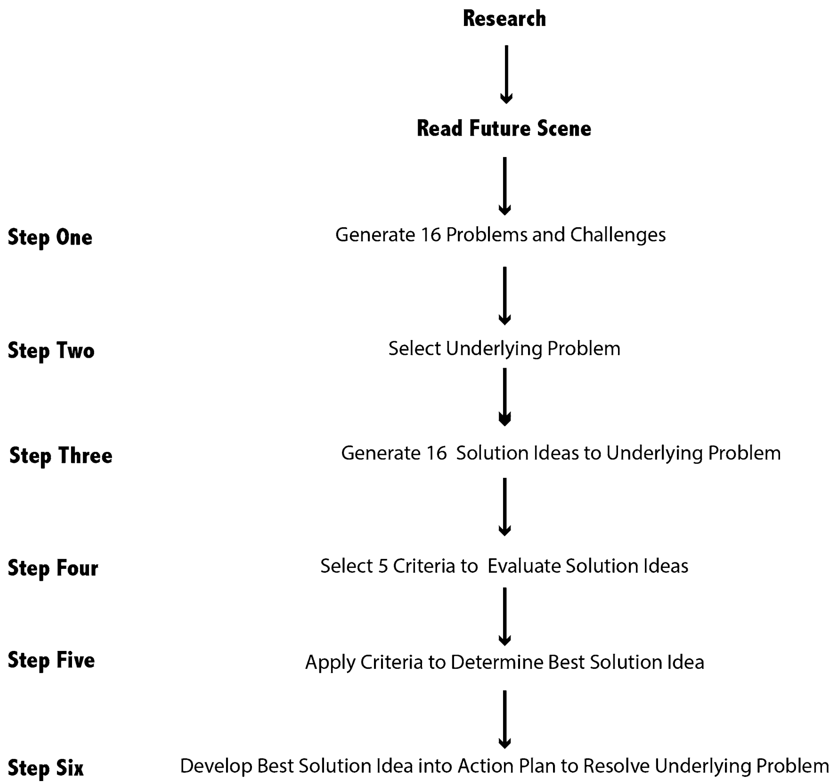

Fig. 1 The six steps of the FPS problem solving process

only adopted the 'International' as part of its title in 2006 (Casinader 2014)—the use of that term to describe the role of the 'educator' has particular implications as it reflects the vernacular of its country of origin: an adult educator who knows what should be done, but who is able to 'coach' students to do the FPS learning by themselves. They are seen as mentors and facilitators, and not as teachers or part of the FPS inquiry team themselves. Such an interpretation is supported by the fact that, in many cases, the 'coach' may be a parent of one of the children involved rather than an independent adult from the team members' school. In Affiliates such as Australia, senior secondary students who have been participating in the FPS Program for some years are also drafted as coaches, a role that many continue when they leave the school and move into tertiary studies or employment. In other words, it is not necessarily essential for the coach to be a trained educator as the role is more one of a guide or mentor.

The multiple orientations that a 'coach' must be ready to take are aligned with the varied range of possible classroom goals that were discussed in Chap. 1. The decisions that a coach must make in deciding which orientation to adopt are based fundamentally not only on what the coach themselves know, but also more on their awareness of what the student is able to do and how the coach can encourage their use of appropriate materials and skills during the investigation. It is the coach who must be able to perceive the various habits of mind that would lead to different perspectives on the investigation, how it might proceed, and then guide the student into seeing the same range of possibilities and then making the final decision as to how to move the inquiry forward.

Such coaching parameters, in which the focus on the development of students' higher order thinking skills rather than employing the adult's thinking expertise, are highlighted by the administrative and evaluation rules surrounding the FPS learning options themselves. For example, the GIPS option concludes with the team undertaking the 2-h written analysis of an unseen 'future scene', or topic-related futuristic scenario, with specific instructions that the coach is not to be involved in any way, except for duty-of-care supervision. In practice, this condition is enacted by the coach sitting at the front of or outside the room in which the team is sitting, acting purely as monitor and timekeeper. In Australia, the students and coach have to sign the cover sheet of the completed 'booklet' to certify that the work is the students' own. Evaluation of the CmPS projects, which takes the form of a 3-D informational tabletop display and other elements, incorporates an interview of the team by the judges, the purpose of which is to determine '…whether the students actually made the contacts, gave the presentations, and directed the action, etc. or if the coach did most of the planning and implementation' (Future Problem Solving Program International (FPSPI) 2016b, p. 13). To see the coach in such restricted terms, however, is merely to replicate and reinforce the afore-mentioned tropes about the nature of IBL and how it is practised in a learning environment. It implies that there is little or no teaching skill or 'art' in IBL, and only serves to promote an attitude that there is minimal professional competence involved in the role of the FPS coach as a teacher or an educator. The reality of effective IBL, however, is that a classroom teacher must possess the knowledge and understanding of inquiry if it is to achieve its educational objectives.

As if in support of this supposition, it is pertinent that, from its early years, written accounts about the FPS Program have focused on what the students do (Casinader 1995; Crabbe 1989), rather than the work of the coach. Whilst research studies on FPSPI are relatively uncommon, it is significant that those that are available invariably focus on student achievement and progress (for example, Volk 2003). Even studies that have centred on the coach or educator have been more concerned with teacher efficacy rather than their conduct of the FPS 'coaching' as such (for example, Rogalla and Margison 2004). Such emphases, intentional or not, reinforce the less dominant role that FPS coaches are recommended—and even required—to adopt in educating their students in FPS problem-solving inquiry; that is, the coach is required to have a low locus of control. Nevertheless, an examination of the FPSPI and Australian Affiliate coaching handbooks (Future Problem Solving Program Australia 2008; Future Problem Solving Program International (FPSPI) 2016a), together with the knowledge gained through Casinader's longstanding FPS involvement as coach, national administrator and in global governance, enables some analysis of how educators might approach the role of teacher (coach) in an IBL-centred FPS learning experience. Kidman (2016) explored the role of the classroom teacher during inquiry-based teaching and learning experiences. Her extensive classroom analysis revealed three distinct phases of the inquiry—the exploratory, the evidence gathering and the sense making. These three phases are also evident in the FPS process. The role of the teacher/coach involves six key behaviours (facilitator if interpretation, mentor, organiser, discussion facilitator, direct instruction provider and questioner). The enactment of these behaviours varies within and between each phase, and the teacher/coach locus of control. This is illustrated in Fig. 2.

The FPSPI has three levels of participation, defined by school grade levels: Junior (Grade 5–6); Middle (7–9) and Senior (10–12). Although lower primary options do exist, these are largely Affiliate derived and centred, especially in the larger Affiliates such as Texas and Australia. The consequence of this structure is that the role of the coach varies with student progression, but is still housed in the three phases described by Kidman (2016). Assuming that students continue with the FPS Program for at least 6 years, there will be a transition for the coach towards more of a facilitator of inquiry, as opposed to being a teacher of inquiry. As the

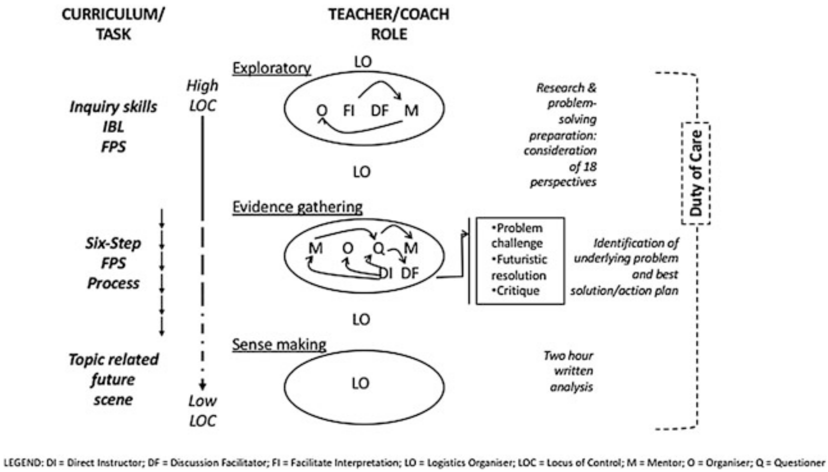

Fig. 2 The role of the teacher/coach in future problem solving: The global issues problem solving option

student progresses, they develop inquiry literacy, and the role of the teacher changes accordingly.

As illustrated by Fig. 2, which employs the FPS context of a Global Issues team of four students in upper primary (elementary) school, the overall role of the teacher is determined by the need to create the conditions under which the team can undertake the six-step FPS process analysis, independent of the coach. In that sense, it is dominated by the organising of discussion forums, in which the posing of questions by students is central. Nevertheless, at this early stage of inquiry-learning, the adult/coach must focus on the teaching of researching skills. It is these that will enable students to compile the knowledge resource base that the team can use as a foundation for the posing of questions. This is essential in the early phases of developing inquiry literacy. The process of FPS inquiry is characterised by the coach teaching the team about the tools by which they can then question the content, validity and relevance of the information they have gathered as part of their FPS analysis. The importance of questioning, in its many forms, is further discussed in Chap. 5. The coach is there as an expediter of student inquiry and *inquiry literacy*, in which the only questions that are asked by the adult of those that are designed to encourage the students to connect the intent and technique of each GIPS step to their research-based analysis of the futuristic situation that, in the language of FPS, is described as the 'future scene'.

Nevertheless, there is an important degree of direct instruction that must take place when students first participate in the FPS Program. Using whatever pedagogical and resource tools that the teacher/coach feels are in tune with the characteristics and needs for the students, the group is taught the technical language and thinking processes embodied in the FPS six-step process (see Fig. 1). The degree to which this occurs in one set of 'lessons' depends upon the context of the particular learning environment, but it is more usual for coaches to focus initially on the 'spirit' of each step, and address any technical issues in terms of format and language afterwards. Once teams have been in the Program for a few years, the degree of direct instruction decreases, and the coach role becomes far more centred on mentoring and facilitation; in other words, the coach develops an increasingly lower locus of control as the FPS expertise of the student increases. Locus of control from Coach will decrease as the intellectual sophistication of the student increases, as depicted in Fig. 1 of Chap. 1.

In Australia, the encouragement provided by the national Affiliate to experienced senior secondary students to be trained and accredited as coaches and evaluators (markers of official student submissions) accentuates this progressive transition even further, as the teacher/coach becomes more of a mentor of the student assistant coaches rather than the participating students themselves. As such, this represents an ultimate form of IBL, in which a student's grasp of inquiry as a self-initiated and guided process becomes actualised into a highly sophisticated manifestation—inquiry literacy to such an extent that the student becomes transformed into an inquiry-based teacher.

Although no FPS research evidence exists to date, there is strong anecdotal evidence that the priorities of national educational policies and traditions have a clear impact on the nature of direct instruction and how it is implemented across different affiliates. One example of this is the difference in the evaluation guidelines produced by FPSP International for the Global Issues learning option, and its counterpart in Australia. Under FPSP International bylaws, individual Affiliates are able to adapt learning options (including the evaluation systems) to meet the circumstances and needs of their local educational contexts, with the understanding that for the international final competition—which is held each June in the USA—is undertaken under the aegis of the international evaluation guidelines for each component. A comparison of the international version for GIPS evaluation (Future Problem Solving Program International (FPSPI) 2016c) with the Australian version (Future Problem Solving Program Australia 2015), demonstrates that the international system, which is devised essentially from the US perspective, places a greater prominence on technical accuracy in the international version for each step of the process. In contrast, the Australian version inserts extra criteria that accentuate overall quality of thought and creative thinking, and that de-emphasise, to a certain extent, the relevant importance of technical precision in how responses are constructed. It is one example of how international constructions of IBL can vary in their points of priority.

3 Inquiry Contexts and the Teacher

The conduct of IBL within schools takes place within two types of learning environments: the Classroom Learning Environment (CLE) and the Field Learning Environment (FLE). In general terms, CLE educational experiences are conducted indoors within the confines of whatever represent a typical classroom within the educational institution, whereas FLE educational experiences are undertaken at locations away from the indoor school environment, whether this be inside the grounds of the educational setting, or at a location in the real world at large. Although they are conducted indoors in a different form of educational institution, archival learning experiences such as research visits to national or State libraries would still be classified as FLE experiences as they are away from the indoor learning environments that the students are accustomed to.

Since CLE experiences are undertaken within the physical constraints of the built school environment, compared with the relative freedom of students to move around in a FLE, the role of the teacher must inevitably vary, whether or not an IBL experience is being employed. In its simplest connotation, the difference between CLE and FLE educational experiences in the Humanities might be defined as being that the former involves the application of IBL to given secondary data (that is, provided by the teacher), whereas the latter is primarily concerned with the generation of primary data collected by the student. Whilst there is a substantial element of truth in this separation, one that leads to FLE experiences being more conventionally referred to as fieldwork (see Chap. 9), the differences and similarities between the two are far more nuanced. In the Sciences, CLEs are also context for generating primary data through investigations in a laboratory setting.

One of the major impacts of societal technology on the educational process that it has made knowledge and information about places and events, past and present, far more directly accessible to students from within the classroom. Students can now research databases directly, wherever in the world they are located, using the complex web of interactive and Internet connected sources, the most common examples of which are the digitised collections of libraries and archival depositories around the world. At one time, an IBL experience that was centred upon, for example, Impressionist Art, would have relied on the teacher supplying a range of visual material to students that represented the images connected with that genre. As a result, any subsequent inquiry-learning sequence was inevitably determined by the nature and range of material supplied by the teacher, which, depending upon the individual teacher's inquiry literacy and understanding of the inquiry processes, would be influenced by their own interpretations and value judgements. This form of IPL can be seen as representing guided IBL at its extreme. Today, however, the impact of technology has opened the 'real' world up to the students in ways that the individual teacher was not able to do in the past.

As a corollary of this, in the past, FLEs were often seen as the only general way in which students could get experience in relatively unaffected direct data collection as part of an open inquiry. The role of the teacher certainly had some influence on the nature of that student experience, for it was (and is) the adult educator who decides on the location of that particular FLE, as well as the data gathering activities that take place. Nevertheless, outdoor environments are subject to change in fairly short time periods; unexpected changes in weather being the most obvious example. In such circumstances, the primary data that students might collect at the fieldwork site are likely to be singular to the specific time of their own experience, but not necessarily reflective of the location generally. For example, damage to a beach during a storm would provide excellent source material for a study of change after a natural weather event if the data collection was conducted afterwards, but those observations would not be representative of the beach in its normative state. In educational terms, however, it is such anomalous situations that often provide the most interesting FLEs for students, as the investigation would not reflect any theory or 'conventional' knowledge that they might have learned and/or been taught beforehand.

Within these older contexts of IBL, the disciplinary differences between the inquiry approaches in the CLE situation were highlighted. For scientists, the most valid form of educational inquiry was laboratory work, in which students tested and validated certain established scientific principles through a range of experiments. In Geography and History, IBL in terms of primary data were limited to such exercises as the study of topographic maps and other similar paper-based recordings. In such cases, however, including the scientific laboratory, the aforementioned dependence, and possibly, liability, of inquiry was founded on the selection of data by the **teacher**, not the collection of data through decisions made and implemented by the student, was reinforced. In the modern age, however, the ability, or capacity, for students now to access a wider range of information about any particular topic through their own decisions, made as part of an individual Internet exploration, means that they are able to be more in control of the questioning regime of their inquiry. This is explored in more detail in Chap. 5.

In theory, then, the CLE experience has been liberated by modern forms of data storage and dissemination, freeing up the possibilities for students to engage in primary data collection through virtual conduits (see Chap. 8). Instead of having to rely on student exploration of secondary sources during inquiries, Geography and History students can develop independence and inquiry literacy skills through the observation, interpretation and analysis of primary data such as archival historical records and digital museum collections. Advances in the cost and accessibility of GIS (Geographic Information Systems) data, both raw and in the form of spatially oriented software such as Google Earth, have made it feasible for students—school technology resources permitting—to generate their own geographical data in the course of exploring a specific topic or theme.

In practice, of course, the very existence of technology does not mean that it will be employed effectively in IBL experiences. The degree to which students are able to utilise these newer vehicles of independent inquiry is still reliant on the inquiry literacy and expertise of the teacher, or more specifically, their expertise not just in the use of technology per se in teaching and learning, but how it can be employed in inquiry-based teaching. The same dependence upon the vision and capabilities of the individual teacher is, if anything, even more significant than was the case when the teacher was the source of all information on which student inquiry was based. The ability of individual teachers to exploit the potential of this technological reach into primary data is inevitably variable, and the capacity of educators to construct inquiry-framed CLE experiences that are founded on contemporary data sources and techniques is similarly inconsistent. Such competencies are not just dependent upon the technological expertise of the individual, but are also influenced by the extent of their curriculum development and implementation expertise. The possession of one is no guarantee of expertise in the other, and neither is the assumption that an educator with a depth of expertise in ICT and curriculum construction has a strong pedagogical grasp of how the process of inquiry in their primary teaching disciplines is perceived and implemented.

The wider horizons of inquiry that technology has opened up for disciplines such as Geography and History can also be observed in the opportunities for experiments and investigations in Science CLEs, as practised under the accepted laboratory-sited model of scientific inquiry in schools. In particular, the expansion of the scientific curriculum into areas such as electronics and robotics has provided Science, in the educational setting, with a much broader scope. Technology has also provided Science teachers with the ability to organise IBL in which the measurement of scientific behaviours previously incompatible with a school environment can now be conducted. However, although the balloon of scientific inquiry has expanded in scope, for many students the essential CLE experience has not altered. Scientific inquiry is still framed around the idea of experimentation and investigations that are pre-planned and pre-destined, designed to enable students to conduct their own brief journey of inquiry. The student does not discover points of knowledge or ideas that are of their own making. Instead the student is enabled to see and understand scientific principles that have already been proven. The Australian state of Queensland is the exception here. In the lead-up to the Australian curriculum, Science students completed up to four Extended Experimental Investigations (EEI) during their final 2 years of schooling (Queensland Studies Authority (QSA) 2004). The guidelines were that when an EEI was undertaken for the first time in Year 11 (Semester 1), the investigation was scaffolded by the teacher to help students complete the investigation by modelling the investigation processes, and familiarising students with the expectations. Subsequent investigations saw low locus of control by the teacher.

Perhaps ironically, it is in the newer areas of electronics and robotics, where problem-solving competitions and challenges have begun to abound (for example, with respect to Lego robotics—FIRST®, FIRST Robotics Competition, FRC®, FIRST Tech Challenge and FTC®), with the conception of scientific inquiry in the educational context may begin to be reconfigured. The underlying issue as to whether the teacher has the ability and capacity to see the possibilities of inquiry under a new scientific mould, however, is still pertinent, and perhaps even more so. Technology, or any tool that may be the vehicle for conducting an educational inquiry, is not the primary condition for effective IBL to take place; it is the ability and capacity of the individual educator to perceive the potential of an educational situation, and then have the drive and motivation to exploit it, using whatever professional knowledges and skills they have acquired; that is, it is the teacher's own inquiry literacy that is paramount.

4 Implications and Comparisons: A Cross-Disciplinary Reflection

Regardless of these disciplinary differences and similarities in approaches to IBL, the capacity and ability of the individual teacher to perceive and generate situations for productive student-centred inquiry, as introduced at the end of Sect. 3 of this chapter, still remains the foundation on which effective IBL must be introduced. The challenges of giving students the confidence and expertise to undertake IBL as independent thinkers can often be overlooked if the teachers themselves are unsure and insecure about the nature of conducting an inquiry-based **teaching**. That is, if the teacher is not inquiry literate, there is a little chance that they can facilitate effective inquiry processes for their students.

Productive and effective IBL, evidence of which can only be fully assessed by the behaviour and actions of students after having undertaken school-based experiences, requires teachers who themselves have developed an appropriate inquiry literacy, regardless of their disciplinary focus. As reflected in IBL programs such as FPS, in which student commitment over a long period of time is demanded, the capacity of the teacher to motivate and engage the student in the possibilities of an independent inquiry capacity is a strong determinant in the success of any individual student. It is not uncommon, for instance, to hear FPS coaches refer to the joy that they feel when students keep returning to participate in the FPS Program year after year, or when some of those students, despite engaging and embarking on widely diverse professional careers, maintain such a passion for the learning benefits of FPS that they have returned to help administer the Program to school students of the next generation (Future Problem Solving Program

Australia 2014). Inquiry-based **teaching**, as much as IBL, depends upon the teacher being comfortable in giving up both the title and implied authority of that very name, and becoming a coach, mentor, facilitator and critical friend.

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