# Assessment on impact of in-service, inquiry based and intensive professional development program on the methodologies, beliefs and attitudes for senior secondary mathematics teachers in their classroom teaching.

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## Abstract

There has been abundance awareness about enhancing the skills and abilities of students in mathematics at senior secondary level. One critical factor is the quality of teacher education programs for preparing mathematics teachers for senior secondary. For  this Open-ended interviews had been used to study variations in senior secondary teacher's views about perfect classroom approaches formed by exposure to in-service, inquiry based and intensive professional development applications based on extraordinary theoretical frameworks. Teachers who had participated in an extensive, inquiry-primarily based, in-provider professional development  program  that targeted on preferred teaching  methodologies from a constructivist, inquiry-based totally attitude defined in the "first-rate practices" literature had been in comparison with teachers who have been via conventional in service professional development program. Analysis of interviews primarily based on the academics' responses to both intangible and numerical questions that involved the idea of compactness found out perception into the teachers' desired teaching methodologies, their ideas about how students analyze, their attitudes towards their  personal  learning, and their depth of expertise of the concept  of compactness.  This research paper assessing that, for a few teachers, extensive in-service professional development  can  produce  a  significant  change  in senior secondary teachers' approaches  about  their useful teaching practice in the mathematics classroom . But this modification can have unforeseen consequences; in this situation, the formation of a set  of ideas that forgot the significance of constructing quantitative skills as well a conceptual understanding  of the standards being taught.

**Keywords:** Teachers, Senior secondary, Intensive, in service, inquiry based, Tecahing mathematics, Classroom, Professional development program.

## Introduction

Currently institutions attempting improvement and trying for reform of the mathematics education in our schools. In spite of tremendous efforts to shift classroom exercise closer to a constructivist, inquiry-based classroom environment, many teachers nevertheless observe a conventional technique (Lotter, Harwood & Bonner, 2007; Shymansky & Kyle, 1992; Shymansky, Kyle, & Alport, 2003).

In order to attain long-term adjustments inside the teaching and learning process it's miles crucial to pay attention to and reflect upon the consequences of teachers' voices because instructors' ideas have a strong affect on their classroom exercise (Brickhouse & Bodner, 1992; Nespor, 1987; Pajares, 1992; Richardson, 19 ninety six). Teachers' ideas approximately teaching and learning have been shown to have an impact on the implementation of both pedagogical and content material specific reforms (Lotter, Harwood & Bonner, 2007; Tobin & McRobbie, 1996). Teachers' ideas are in particular vital  within the context of professional development programs because teachers

who query whether or not the content material or practices being endorsed will be useful are no longer probable to comprise this content material or practices in their classrooms (Richardson, 1996).

This take a look at used in-intensity interviews primarily based on both conceptual and mathematical questions that involved the concept of density to evaluate the consequences of an inquiry-based, in-service expert improvement program on instructors' perceptions of what constitutes an effective teaching and learning surroundings with similarly in depth expert development program that lacked the equal coherent link. This examine become not a try and describe the fact of the school room practices employed via the intermediate science instructors worried inside the studies that become finished. It centered on the academics' beliefs about "satisfactory practices" for teaching mathematics in senior secondary classroom that resulted from exposure to expert improvement activities.

## Factors of Old Teaching Practice

Many attempts have been made to differentiate among "conventional" and "constructivist" teachers. Fraser (1994) argued that: "In old practice, teachers have conceived their roles to be concerned with revealing or transmitting the logical structures in their information and directing students via rational inquiry toward discovering predetermined established truths ." Driver (1989) has argued that instructors who undertake the constructivist theory query college student's solutions, whether they're right or incorrect, to make sure that they and their college students are the usage of the identical words to describe the identical phenomena; insist that students give an explanation for the answers they give; do not permit college students to apply words or equations without explaining them; and encourage students to reflect on their answers, which is an essential a part of the learning process. Constructivist processes to instruction require a diffused shift in viewpoint for the person who stands in the front of the classroom. A shift from someone who "teaches" to a person who "helps getting to know"; from teaching by imposition to teaching by using negotiation (Herron, 1984). While conventional instructors have a tendency to create teacher-centered or content material-centered classrooms, constructivist instructors are greater possibly to produce student focused classrooms (Simmons, et al., 1999).The constructivist theory offers a foundation for categorizing teachers as "constructivist" or "conventional" by way of analyzing their classroom practice. But we believe that it also offers us with the idea for predicting into which of those categories a instructor belongs via asking them to explain how they would layout preparation to confront students' misconceptions, which become the technique used on this take a look at.

## Techniques

The theoretical framework turned into deemed appropriate because the organization classified as "constructivist" instructors have been involved in a systematic reform mission for more than years, and within the techniques had created their personal subculture that guided their approach to the teaching and learning to know process. The institution of conventional instructors with whom the reform-movement teachers had been as compared had additionally been uncovered to big professional development activities, but these tricks lacked the coherence and articulation of the systematic reform undertaking.

There is purpose to assume that the ideals the traditional teachers added to their classroom practices have been the result of a mixture of the tradition of teaching that permeated their college years, their experiences going through a instructor preparation application, and subsequent in-service professional improvement.

This study changed into based on four guiding studies questions.

- How do the teaching methodologies of senior secondary level mathematics instructors who participated in a systematic reform project range from those of conventional instructors.

- Are beliefs about the studying manner distinctive for reform-motion and conventional senior secondary level mathematics instructors.

- Are attitudes towards getting to know one of a kind for reform-movement and conventional senior secondary level mathematics instructors?

- How does the depth of each conceptual and mathematical knowledge of reform-motion and conventional senior secondary level mathematics instructors assess?

Data were accrued the usage of a qualitative research methodology primarily based on a series of semi-structured interviews. These instructors were decided on the basis of the following criteria:

❖ Instructors are teaching mathematics at senior secondary level from more than five years.

❖ Instructors were teaching mathematics at that stage when the study become being accomplished.

❖ Instructors had attended already more than five professional development programs in recent years.

The interview procedure curved into planned crossways the set of questions and each of the interview questions become offered on a separate sheet that contained a simple diagram illustrating the basic factors of the query. For every question, the instructors have been requested to: guess the most usual answer their students might give, give the answer of the question himself, and explain what they would do if their answer was not similar to the answer they guess their students would give if this question became asked in class.

The teachers had been interviewed at their personal faculties at some stage in their normal hour for training, aside from one teacher who becomes interviewed after college hours. The evaluation of the interview transcripts targeted on universal patterns that would offer perception into observable differences between the groups of teachers. Coding of interview transcripts centered on recognizing patterns in the instructors' responses that were related to the research questions. A consistent comparative approach (Strauss & Corbin, 1990) turned into used inside the analysis of the facts that produced classes into which ends can be organized: *teaching methodologies, beliefs approximately how people learn, attitude toward getting to know, and depth of conceptual know-how of density.*

## Outcome of the Research on following factors

### 1) Teaching Methodologies

One a part of the interview protocol for each query in this observe requested the teachers to explain what they would do if their students gave what the teachers believed were "wrong" solutions to the question. The aim of this part of the interview becomes to benefit perception into how the teachers would shape their classroom conduct to confront college students' misconceptions of the idea of density.

A fresh outline emerged among the reform-movement instructors, who stated that they might use hands-on materials in an inquiry-primarily based way in order to assist their students understand the concepts. The reform-movement instructors continuously noted that they might strive to mirror the questions with real substances inside the classroom. They explained how they could acquire the important materials, how they could installation the experiments, what questions they could ask, and the way they could guide the students via the procedure.

### 2) Beliefs Approximately How Students Learn

Beliefs of instructors are extensive, even though the term "beliefs" has been explain as confusing (Pajares, 1992). It has been argued that instructors' beliefs approximately learning are based totally on a "folks pedagogy" received via their lifelong reports (Bruner, 1996) and honed by the numerous years they spent as college students or instructors in numerous classrooms . Because their beliefs about learning of have an impact at the way teachers shape the classroom environment (Brickhouse & Bodner, 1992; Nespor, 1987; Pajares, 1992; Richardson, 1996), the extent to which these beliefs can be changed is of interest to trainer educators.

The two institutions of teachers who participated in this work were similar in terms of historical past, ethnicity, educational education, years of teaching experience, and quantity of professional development program. They differed, however, within the sort of in-service activities to which they had been uncovered. As cited previously, the folks who were selected as examples of reform-movement teachers received an extensive in-service schooling application primarily based on inquiry-based, constructivist teaching methodologies that focused on educational methods, rather than course content.

The reform movement instructors believed that their students answer is better while they find out something via themselves. Throughout the interviews, they commented on their mind about how their students assume, and time and again referred to that their students brought to their technological know-how classes many questions from regular lifestyles. Their description of their school room practices and the manner their college students behave advised that they believed that students learn fine in a student's -centered environment, where the instructor provides reports that allow the students to:

- Build their personal thoughts about mathematics,

- Bring context to the ideas being discussed in magnificence

- Learn by using doing, observing, and analyzing. They expressed the belief that that is a everyday teaching and learning of surroundings that they not simplest can, however need to, promote.

The conventional instructors, then again, confirmed their perception that learning happens when the instructor offers excellent, clear reasons. Their very own answers to the interview questions targeted on recalling the appropriate solution.

The use of experiments became mentioned within the context of comments approximately their remembering something they had been informed, now not something that might be a powerful way of teaching or learning.

### 3) Attitude on the way to Learning

The time period "attitude" has been defined as a high quality or terrible evaluation of humans, objects, instance, activities, or thoughts in an individual's surroundings that impacts the way that individual responds to an external stimulus (Zimbardo and Gerrig, 1999). In this research paper, the instructors' attitude closer to learning changed into assessed through examining how comfy they had been whilst placed in a situation in which they did not understand the answer to a query.

Reform-movement teachers proven the equal approach to confronting what turned into, to them,a tough trouble. Although it was clear that they had been now not positivity about their answers, they expressed self assurance of their capacity to locate the solution for themselves by calmly describing how they would cross about setting up a test to discover the right answer. They appeared to understand what to do and a way to use their know-how to address the problem. Furthermore, they have been explicit in expressing their personal curiosity approximately the problem and their interest in learning the ideal solution.

The conventional instructors were greater direct in their solutions and appeared to be repeating what they recalled have to be the ideal solution. These instructors did now not showcase any interest in getting the proper solution to the conceptual questions or in studying more approximately the concept or ideas. They exhibited a phenomenon that has been referred to as a "problem-solving attitude" (Bodner & Herron, 2002; Gardner & Bodner, 2006); they simplest seemed to fee responsibilities that had a quantitative solution.

The conventional instructors all predicted that their college students would think that ice floats on water due to the fact it is "lighter" or has less mass. Four of these teachers then right away spoke back that ice floats due to the fact it is much less dense. When the interviewer asked them to explain why ice is much less dense than water, they appeared harassed and exhibited frustration at now not being able to keep in mind the right solution. The biggest quantity of misconceptions and invocation of ideas unrelated to the phenomenon beneath dialogue came about amongst this institution. One trainer used the phrases "cohesion" and "adhesion," as an example, without bearing on them to a real rationalization.

Both their comments and their nonverbal communication counseled that the reform-movement teachers were now not certain of the correct solution to a few of the conceptual questions however they had been cozy in their belief that the solution turned into clean to discover by doing the precise experiments. With simplest one exception, they truly explained how they would prepare the materials to do the experiments, what questions they would ask the scholars, and how they would manual the students in their creation of understanding.

The conventional instructors all gave the wrong solution to the primary question with one exception, the traditional instructors appeared at ease with their solution to the query, even though it turned into wrong. A better label, but, would be "algebraic" (Bodner & Herron, 2002) because the solution is seldom obtained by means of the utility of a rehearsed algorithm. Some hassle fixing conduct involving the manipulation of algebraic symbols is essential.

The reform-motion teachers described density experiments their students had accomplished in which they measured the quantity of a cube by using measuring its facets with a ruler, measured the mass of the dice with a balance, after which divided the mass via the extent.

## Conclusion

While each corporations of teachers in this study had been uncovered to in -service professional development program, they confirmed clear variations inside the manner they translated these reports into their beliefs approximately suitable approaches to present this material in their classroom. The reform-motion teachers stated that they desired the use of palms-on substances to sell discussions among their students. Two of the phrases used most customarily by these instructors had been prediction and remark. A normal phrase became: "... Have the scholars do and notice by way of themselves and reach their very own conclusions based on these observations."

The reform-motion instructors expressed the perception that they ought to actively involve their college students in the mastering method with the aid of beginning with a question and keep wondering for the duration of the gaining knowledge of process to manual the scholars in their own wondering. They expressed the belief that "best practices" for classroom teaching might contain palms-on activities by college students running in businesses, leaving questions unanswered with the purpose that students would be sufficiently influenced to keep experimenting and reach their very own conclusions.

The classroom surroundings depicted by using the reform-motion instructors in this have a look at mighty fine be described as student centered inside the feel of this time period was used.

The teachers in this examine who had been uncovered to traditional expert development activities, on the other hand, expressed beliefs about teaching exercise one might count on of conventional teachers. They regarded to price relying on causes and direct solutions to students' questions. They expressed the opinion that the gold standard lecture room surroundings could encompass offering sufficient opportunities for college kids to invite questions, but that less time need to be committed to probing their students' know-how. They noted that they would be much less possibly to apply fingers-on substances and greater probably to rely on the blackboard, drawings, and oral reasons. The study room environment depicted with the aid of the conventional instructors in this have a look at can nice be described as teacher centered (Simmons, et al., 1999).

The reform-movement instructors again and again mentioned that their students examine first-class whilst they find out expertise by means of themselves inside the context of their regular lives. Although the conventional instructors did now not explicitly mention that explaining and giving direct spark off answers to questions became the "accurate" methodology to get students to learn, it become implicit in their interviews that this is the nice manner to educate. The conventional instructors did not offer any proof to endorse that they reflected on the getting to know technique of their college students, or on the teaching and learning to know process going on in their classrooms.

There changed into a substantial difference among the reform-movement and conventional instructors' mind-set closer to their very own studying. The reform-motion teachers established an hobby in getting to know greater when they perceived they did no longer understand. They exhibited curiosity approximately the answers to the conceptual questions and cautiously described how they could cross approximately locating out the proper solution to a difficult hassle. They tended to discuss difficult issues with different teachers to be able to help every different discover the right answer.

The conventional teachers had been much less possibly to be aware about errors of their method to unexpected troubles. They tended to give what they felt turned into the "accurate" answer and infrequently pondered out -loud whether or not they had been right. When faced with a strange trouble, the reform-movement instructors' attitude

became "allows find out" or "please permit's talk this after the interview," whilst the traditional instructors have been more likely to seem demanding and say "I don't recognize."

The conventional instructors have been relatively greater in all likelihood to supply the "correct" solution to a query, however they proven confusion when asked to explain how they knew that solution was accurate. As a rule, they did not recognise a way to achieve the proper solution and, in popular, "knew" however did no longer "apprehend" the solutions. When confronted with a numerical calculation, they had been capable to answer the query with slight difficulty. None of the reform-motion teachers, alternatively, should remedy the quantitative a part of the final problem and maximum of them expressed the need to do an experiment in order to be capable of solution the question.

This research shows that the reform-based expert improvement reports can also have had unforeseen implications that might be of hobby to technological know-how educators involved in each pre-service and in-service teacher instruction programs. In trying to emphasize a constructivist, inquiry-based method to teaching that promotes conceptual expertise, the unintended lesson the academics regarded to acquire is that conventional, quantitative issues that require a numerical, algebraic technique to the answer are not essential. In the destiny, expert development packages in mathematics i that emphasize the importance of promoting both conceptual knowledge and the answer of numerical issues. These packages will focus not most effective on "new" or "distinctive" techniques of teaching technological know-how, but additionally talk traditional processes the teachers want to maintain doing. The subsequent generation of professional development studies will try and be "actual" in terms of modeling the teaching methodologies that correctly develop all kinds of understanding; be it routine ,declarative, theoretical, analogical, or logical (Farnham-Diggory, 1994).

## References

Australian Education Council (1991).A national statement on mathematics in Australian schools. Melbourne: Curriculum Corporation.

Brandt, D. (1992). The cognitive as the social: An ethno methodological approach to writing process research. Written Communication, 9, 315–355.

Brouwer, N., & Korthagen, F. (2005). Can Teacher Education Make a Difference? American Educational Research Journal, 42(1), 153-224.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. Educational Researcher, 18, 42.

Cuban, L. (2001). Oversold and Underused: Reforming Schools through Technology 1980-2000.Cambridge, MA: Harvard University Press.

Change in secondary science teachers' classroom practices. Journal of Research in Science Teaching, 42(6), 668-690.

Calderhead, J., & Robson, M. (1991). Images of teaching: Student teachers' early conceptions of classroom practice. Teaching and Teacher Education, 7, 1-8.

Development effective? Results from a national sample of teachers. American Educational Research Journal, 38(4), 915-945.

Department of Education, Science and Training (2001). Making better connections Models of teacher professional development for the integration of information and communication technology in classroom practice Commonwealth of Australia.

Fraser, B. J., (1994). Research on Classrooms and School Climate. In Gable, D. (Ed.) Handbook of Research on Science Teaching and Learning. New York: Macmillan, p. 527.

Gardner, D. F., & Bodner, G. M. (2006). The existence of a problem-solving mindset among students taking.

Hawley, W. D. & Valli, L. (1999). The essentials of effective professional development: A new consensus.In L. Darling-Hammond & G, Sykes, Teaching as the learning profession: Handbook of policy and practice (pp. 127–150). San Francisco: Jossey-Bass.

Keys, W. C., & Bryan, L. B. (2001). Co-constructing inquiry-based science with teachers: essential research for

Kagan, D. (1992). Implications of research on teacher belief. Educational Psychologist, 27(1), 65-90.

Loucks-Horsley, S., Hewson, P. W., Love, N., & Stiles, K. (1998). Designing professional development for teaching of science and mathematics. Madison, WI: National Institute for Science Education.

Luft, J. A. (2001). Changing inquiry practices and beliefs: The impact of an inquiry-based professional development programme on beginning and experienced secondary science teachers. International Journal of Science Education, 23(5), 517-534.

Nespor, J. (1987). The role of beliefs in the practice of teaching. *Journal of Curriculum Studies*, 19, 317-328.

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, *62*(3), 307-332.

Simmons, P. E., Emory, A., Carter, T., Coker, T., Finnegan, B., Crockett, D., Richardson, L., Yager, R., Craven,J., Tillotson, J., Brunkhorst, H., Twiest, M Hossain, K., Gallagher, J., Duggan-Haas, D., Parker(1999).

 Beginning teachers: Beliefs and classroom Actions. *Journal of Research in Science Teaching*, **36**(8), 930- 954.

Suter, L. E. (1996). *Indicators of Science and Mathematics Education 1995.* Arlington, VA: National Science Foundation, Directorate for Education and Human Resources, Division of Research, Evaluation, and Communication. (NSF 96-52).

Thomas, J. A., & Pedersen, J. E. (2003). Reforming elementary science teacher preparation: What about extant teaching beliefs? *School Science and Mathematics*, 103(7), 319-330.

Wright, J. M. (2008). The comparative effects of constructivist versus traditional teaching methods on the environmental literacy of post-secondary nonscience majors. *Bulletin of Science, Technology and Society*, *28*(4), 324-337 (2008).

Von Glasersfeld, E. (1984). An introduction to radical constructivism. In P. Watzlawick (Ed.), *The invented reality*: *How do we know what we believe we know?*. New York: Norton. pp. 17–40.

Zeichner, K. M. (2005). Becoming a teacher educator: A personal perspective. *Teaching and Teacher Education*, *21*(2) 117-124.