**Australian Journal of Basic and Applied Sciences**, 9(28) Special 2015, Pages: 136-144

ISSN:1991-8178

**Australian Journal of Basic and Applied Sciences**

Journal home page: www.ajbasweb.com


# The Relationship Between Mathematics Homework Engagement And Mathematics Achievement

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**ARTICLE INFO**

***Article history:***
*Received 23 June 2015*
*Accepted 25 July 2015*
*Available online 30 August 2015*

***Keywords:***
*Mathematics Homework Engagement, student's, teacher, parents, school management,mathematics achievement*

**ABSTRACT**

**Background:** Homework is a task given by teachers to students after a lesson is completed. A lots of research done in this field related to achievement. Mathematics is a subject which needs homework to be given after lesson completed by teachers in order to make the students for better understanding of a lesson. Mathematics homework engagement instrument (Murugan & Arsaythamby, 2015) was used to collect the data. Partial Least Squares (PLS) was used as the technique for data analysis. **Objective:** The purpose of this study is to determine the relationship between student's, teacher's, parent's and school management's mathematics homework engagement and mathematics achievement. It is also to predict the mathematics homework engagement based on student's, teacher's, parent's and school management's engagement towards mathematics achievement. **Results:** Results revealed that, only three relationships were supported via the effect of student's, teacher's and school management's mathematics homework engagement on mathematics achievement and parent's mathematics homework engagement on mathematics achievement was not supported. Besides that, the student's achievement has a R2 value of 0.40. The student's engagement, teacher's engagement, parent's engagement and school, management's engagement explained 40.2 percent of variance in student's achievement. **Conclusion:** These findings have important implications and great value to teacher's, school management's, and policy maker regarding on mathematics homework.



**To Cite This Article:** Murugan Rajoo and Arsaythamby Veloo, The Relationship Between Mathematics Homework Engagement And Mathematics Achievement. ***Aust. J. Basic & Appl. Sci.,*** *9(28): 136-144, 2015*

## INTRODUCTION

Homework is a sort of assessment which teachers used to test students comprehension of the subject (Murugan & Arsaythamby, 2015). Reseachers reveals that, homework has a noteworthy relationship with achievement in mathematics. In Malaysia, homework is obligatory to be given to students after a lesson was completed taking into account the need of the students (KPM, 2004). Most of the teachers are offering homework to the students after a lesson were completed.

The general consensus is that all children have to do homework because it is a lesson worth (Hyde, Else-Quest, Alibali, Knuth & Romberg, 2006). According Dettmers *et al*., (2011), homework is an important issue involving the various stakeholders (teachers, students and parents), which plays a different role and impact student learning experience and organization.Homework is one of the important factors that increase achievement (Marzano, 2003; Patall, Cooper, & Robinson, 2008). According to Cooper, homework involves tasks given to students as an extra exercise that needs to be made outside of teaching time (Bembenutty, 2011).

In a research, 90% of students, teachers, and parents believed that homework help students to achieve better. On the other hand, 26% of students, 24% of teachers, and 40% of parents report that some homework is just busywork which not meaningful, and 29% of parents report homework is a "major source of stress" (Markow, Kim, & Liebman, 2007).

### *Literature review:*

### *Student's Mathematics Homework Engagement:*

Students engagement in mathematics homework is once in a while carelessness and unlucky deficiency in any case, there is a fundamental pressure to their obliviousness. The effect of homework to the students may be hard to focus with non-participation or endeavor to do it so as not to misjudge them to comprehend their negative behavior. It may vary as their status in schools, social motivation, family and internal problems each of

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them was confronting everyday. Summing up their general class achievement in their outcome and production may be pivotal as in the motivation of one may not be different with another and it demonstrates in their performance (Henderson & Eren, 2008).

To make homework significant, it ought to additionally be fun and energizing particularly for secondary rural communities to draw in their loved ones to help them. Supplemental learning or utilization of essential manuals, books, the web, calculators and different assets ought to encourage them to accomplish more. Besides, TIMMS (2011) revealed that in Malaysia students engagements in a mathematics lesson was 24% contrasted with international level was 25%. It was accounted for that 59% of the Malaysian students were somehow engaged and 17 % of the students were not occupied with the mathematics lesson. There are studies demonstrating that the complement in finishing homework lead to higher achievement and has a useful impact on the learning results for quite a long time together with the advancement capability of the students (Kuh, 2009). Stoeber *et al*. (2011) in his study, found that the spirit of learning in a controlled manner (no exaggeration) for a student themselves lead to better student engagement. By Hamlet (2000), the key achievement of high academic are problem-solving strategies, skills pay attention and motivation. Outstanding students are students who are more motivated, independent, systematic, and continuous learning.

In Malaysia, the factor of tuition or tutorial is a great pressure on the part of the parents that hinders their desire to hire a tutor. Tutors claim is that they are adding knowledge and human capital to students that they can carry for the rest of their lives Kenayathulla (2013).

H1: Student's mathematics homework engagement is positively related to mathematics achievement

***Teacher's Mathematics Homework Engagement:***

Students may think that this homework provides a burden or a child labor on their part according to Bennett & Kalish (2008) since it takes time instead of an opportunity to play that they need to replace it with studies especially in the subject they hated that is mathematics. Student performance in homework largely depends on their understanding on the oral studies conducted by their teachers during school hours. But if they are unable to understand such topic during classroom hours then by all means they may not be able to understand their homework just the same. Therefore, the quality of instruction is highly important and it is in the hand of teachers and the content being taught if they are able to demonstrate their willingness to teach these students with the support of necessarily available resources which occur secondary Hammond (2006).

Teachers engagement in mathematics in lesson plans and homework is another challenge created by the shift of language from English to Bahasa since the implementation of their basic plans will also need to be changed. Therefore, the change language policy is also the burden of teachers not just in mathematics but also in other subjects. Education Ministry also provided additional training and development for teachers through English Language Teaching Center Malaysia (ELTCM) will be the professional gateway for teachers in their shift of studies (Idris. *et al*., 2006).

In Selangor, teachers believed that good practice in mathematics teaching and a good lesson plan have several advantages it serves as a guide map for teachers and students throughout the year. Student participation is focused on activities to encourage conceptual frameworks they basically enjoy the lessons especially if it is related to their life. Active participation of students should also be reached that this requires good planning and motivation for fun and meaningful productive activities Barkley (2009).

Teachers understand the limitation and time constraint of homework, and examination that they themselves needs to gather these results. This is not to be tough but to inculcate responsibility and promptness to students giving them time to exercise professionalism as they grow. Teachers usually have heavy workload even after class especially in rural schools where teachers likely stay after class to finish their reports (Sam & Mon, 2012).

The effectiveness of homework can be improved by providing a choice of homework tasks students. This directly will result in motivation and higher student performance, student autonomy, and intrinsic motivation (Patall *et al*., 2010). Besides that, mathematical learning is a cognitive and an emotional activity (Else-Quest, Hyde & Hejmadi, 2008), and so a teacher needs consider the academic integrity and the affective consequences when setting homework tasks. Research literature indicates that providing more opportunities for students to respond, it can increase the number of attempts through training that leads to better retention of newly learned knowledge (Cates, 2005).

In addition, the researchers found that when teachers take the time to write comments that promote and build on homework, it has a measurable positive impact on achievement (eg, Hall, Villeme, & Burley, 1989; Omstein, 1994). By providing students with specific information about proper academic performance, such as giving them some credit, and offers additional information about the correct or incomplete homework, this method ensures that the feedback can be a potentially important stronghold for teachers to communicate directly with students on teacher expectations. Feedback can also be a foundation for students to develop personal expectations about their potential and to put a personal explanation as to why they are doing well or not (Hall *et al*., 1989).

Trautwein *et al*. (2009) found that the most effective homework tasks are prepared with students' abilities and interests in mind, but the teachers surveyed did not all agree that students' interests and abilities should be taken into account when creating and implementing homework.

At the point when teachers plan homework to meet particular purposes and objectives, most students complete their homework and gain advantage from the outcomes (Epstein & Van Voorhis, 2001). In fact when homework is appropriately used by teachers, it creates an impact three times bigger as the impact of financial status.

Besides that, when the teacher gives homework to students, teachers should give clear instructions to the students as to how the homework should be implemented to ensure that students are not misconception with homework given (Woolfolk, 2007). De Jong, Westerchof, Creemers (2000) study found that the review and awarding grade homework is not related to student achievement.

H2: Teacher's mathematics homework engagement is positively related to mathematics achievement

***Parent's Mathematics Homework Engagement:***

One of the ways parents can influence a student's academic results is through active participation in the management and study at home. This typically involves activities such as engaging in cognitive tasks associated with the behaviour of students, such as organizing and monitoring schedules of students (Finn, 1998). The active involvement of parents in a home can support and motivate students to learn (Seginer, 2006). The involvement of parents to support and encourage students by rewarding learning behaviour through encouragement and praise, is associated with higher student achievement in school. (Simpkins, Weiss, McCartney, Kreider, & Dearing, 2006).

Throughout the years, the research found that the level of family contribution in homework is not essentially identified with academic achievement. (Balli, Wedman, & Demo, 1997; Cooper *et al*, 2000). In fact, a study (Epstein, 1988), proposing that the invovement of parents in helping students with their homework made a student with lower score achievement.

According to Xu (2009), parental backing with homework structure is vital for students to complete homework. students - boys in secondary schools gain advantage from the family members. Low achievers get additional time when parents help their homework and even came back to the teacher (Patall, Cooper, and Robinson, 2008). Primary school students gain advantage from parental contribution. A meta-analysis 22 sample from 20 studies correlating parent involvement and accomplishment shows a positive relationship to primary school students however a negative relationship for secondary school students (Patall, Cooper, and Robinson 2008).

Researchers such as Cooper *et al*., (2000) have also found that students at higher grade levels received less direct involvement from parents on homework.While some parents believe that homework will help their children succeed and progress with their education, others see homework as unnecessary and intruding on quality time spent with family (Brock*et al*., 2007).

Studies which utilizing both correlations and experimental demonstrated that students in secondary schools do not benefit from parental involvement in homework. parents need to acknowledge about their child's advance and suits accordingly towards the homework process. for example, adolescence is the period where they try to build up some level of independence and self-governing from their guardians in many ways (Gutman & Midgley, 2000). Despite the fact that parents give guidelines for doing homework or give direct help to doing homework but it is a viable type of parental involvement just for primary school students. Students who achieve adolescence stage might be critical for parents to progressively withdraw from the procedure and the involvement of homework and they need to change to a self-sufficient type of backing students' endeavors.

A meta-systematic appraisal of the methods that incite achievement in the middle school directed by Hill and Tyson (2009) recommended that parental help with homework d6es not match with students achievement. However, the routines for parental involvement and help with homework were not inspected separately, and parental help with homework was dealt with as a general idea in Hill and Tyson's study.

A meta-analysis 22 examples from 20 studies involving parent contribution and achievement reveals a positive relationship to school but a negative relationship for secondary school students' (Patall, Cooper, & Robinson 2008). However, homework can cause tension between parents and students (Patall, Cooper, & Robinson 2008; Symeou 2009).

H3: Parent's mathematics homework engagement is positively related to mathematics achievement

***School Management Mathematics Homework Engagement:***

In the exertion of the Malaysian government and the school administration to accomplish higher mathematic performance, students are continually given voluminous homework. although this may not be the response for development for mathematics, considering that a greater amount of the students' assignments, particularly in secondary school students took The International Mathematics and Science Study (TIMSS) to gauge their success.

critics believe that students are bombarded with an excessive amount of homework. This is demonstrated valid by the TIMSS themselves - that Malaysian students are given the most quantities of homework. According to KeithRozario.com (2014), around 63% of students spend no less than 45 minutes of their homework in a solitary subject.

School organization should likewise be cautious to elevate the five ways to deal with bolster and support their ethical (Razak, 2013). These are a decent workplace and management support, the accessibility of materials, tools and endless supply of arrangement; checking through encouragement; constant thankfulness and the advancement for school achievement.

School administration likewise has the power to gauge and upgrade the vital proposals expected to change the framework in mathematics in the event that they feel that there is a need to do as such. They ought to be considered responsible in the educational program providing so as to take into account components of studies sufficient arrangements in their prosperity (Bakar, 2007).

H4: School management's mathematics homework engagement is positively related to mathematics achievement

***Objectives of the Study:***

The purpose of this study are:

1. Determine the relationship between mathematics achievement towards student's, teacher's, parent's and school management's mathematics homework engagement
2. Predict the relationship between the mathematics homework engagement (student's, teacher's, parent's and school management's engagement) and mathematics achievement utilizing PLS-SEM.

***Methodology:***

Respondents of this study are 380 tenth grade secondary school students from Sabah state, Malaysia.

***Data Collection:***

The mathematics homework engagement (Murugan & Arsaythamby, 2015) questionnaire was distributed among 415 tenth grade secondary school students from Sabah state, Malaysia. Of the 415 questionnaires distributed, 392 instruments were returned. Number of usable questionnaires after screening data was 380.

***Findings:***

***Hypotheses Testing:***

In this section, the researcher preceded with the path analysis to test the four hypotheses generated for research questions. The table 1.1 shows that the result of all relationships between independents variables and students' achievement.

**Table 1.1 :** Result of hypothesis testing

| Hypothesis | t | p |
|---|---|---|
| Ha1: There is a positive relationship between parents' engagement and students' achievement. | 1.43 | 0.15 |
| Ha2: There is a positive relationship between students' engagement and students' achievement | 3.21 | 0.00* |
| Ha3: There is a positive relationship between school management' engagement and students' achievement | 2.39 | 0.02* |
| Ha4: There is a positive relationship between teachers' engagement and students' achievement | 3.71 | 0.00* |

*p<0.05, p >0.05

***Model Validation:***

The data were analysed in several separate, but sequentially related steps. The data were analysed, using Smart-PLS 2.0. A PLS-SEM path model can be validated at three levels (Tenenhaus *et al*. 2004), the quality of the measurement model, the quality of the structural model, each structural regression equation. To assess partial model structures, there are several criteria. A systematic application of these criteria is a two-step process, encompassing (1) the assessment of the outer model (measurement model) and (2) the assessment of the inner model (structural model).Generally, outer model assessment includes: reliability and validity of reflective constructs and inner model assessment include a variance explanation of endogenous constructs, effect sizes, and predictive relevance. Firstly, the researcher reported the indicator reliability, composite reliability (CR) and loading factors for model. Secondly, the path confidents and $R^2$ values explained for current model.

To evaluate the significance and the explanatory power of the measurement model, certain criteria need to be assessed. Reflective measurement models should be assessed with regard to their reliability and validity. In order to develop the measurement model at first factor analysis by Smart-PLS conducted and the items of construct which had lower factor loading removed. The result of before and after factor analysis are presented in the following Figures 1.1 and 1.2.

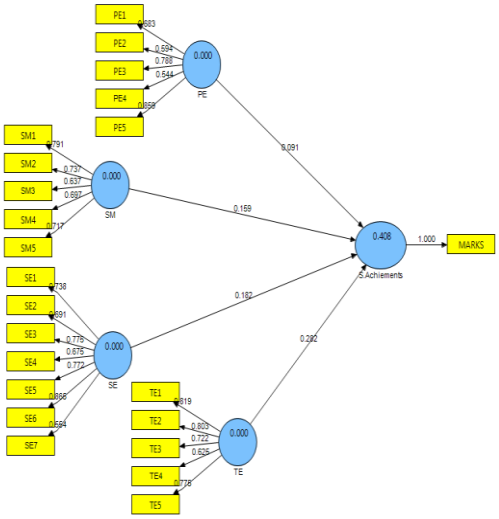


**Fig. 1.1:** PLS model before removing low loading factors.

The Figure 1.1 showed the construction included low standardized loading factor were less than the cut-off criteria and decrease the validity and reliability of constructs thus these items were deleted. Overall, the items PE4, SM3, SE7, and TE4 had low loading factors. To increasing reliability and validity of constructs the items which had low standardized loading factor eliminated (except PE2 with factor loading 0.59 due to the AVE and CR was high) of these constructs the result after eliminating low loading factors indicated Figure 1.2.

**Table 1.2 :** Internal Consistency reliability and Indicator Reliability

| Construtcs | items | alpha | Loadings Factors range |
|---|---|---|---|
| PE | 4 | 0.744 | 0.58-0.89 |
| SE | 6 | 0.860 | 0.70-0.86 |
| SM | 4 | 0.752 | 0.72-0.80 |
| TE | 4 | 0.808 | 0.72-0.83 |

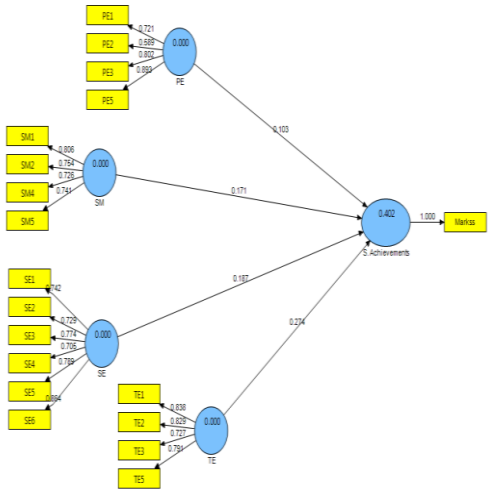


**Fig. 1.2:** PLS model after removing low loading factors for main effects (Model1)

Figure 1.2 showed a item from parent engagement construct (PE4), school management (SM3), student engagement (SE7), and a item (TE4) from teacher engagement removed and the AVE and reliability of these constructs increased.The item PE2 did not removed with factor loading 0.594 due to AVE and CR was high. In next section, the reliability and validity of constructs will discuss.

***Indicator reliability:***

In the evaluation of measurement model, first standard was to survey the internal consistency of the measuring observed variables/things with one another. Results on table 1.13 demonstrates that the supreme relationship between the construct and its measuring show things (i.e. factor loading); the factor loading was ranging from 0.58 to 0.86 and

fulfilled the prerequisites of the psychometric reliability test (Henseler and Fassott, 2010). Overall, among the numerous factual techniques to gauge reliablity such as spilt-half, Cronbach's alpha, and test-retest (Hair *et al*. 2008), for the present study Cronbach's alpha coefficient system was chosen. Results in Table 1.2 showcases that Cronbach's α was higher than the suggested worth 0.6 (Cronbach 1951) Moreover, square each of the outer loadings shows the indicator reliability value 0.70 or higher is preferred. If it is an exploratory research, 0.4 or higher is acceptable. (Hulland 1999). With regards Table 1.15 it can be seen that all of the indicators have individual indicator reliability values that are much larger than the minimum acceptable level of 0.40.

***Loading factors, composite reliability (CR) and average variance extracted (AVE):***

Before testing moderating effect, the measurement model assessment such as loadings, AVE and CR reported. Table 1.3 showed that the minimum loading factor belong to PE2 (parent engagement) and slightly low than threshold (0.7) but there is no issue due to AVE and CR is high. All constructs have acceptable AVE (>0.5) and CR (> 0.7).

***Path Coefficients and $R^2$ Values:***

PLS-SEM is centered around prediction and its goal is the expanding of the variance of needy variables, the first criterion is to survey a PLS-SEM model is the assessment of the coefficient of determination (R2) of the endogenous develop (Chin & Dibbern 2010). The R2 value represents a measure of the predictive power and point to the amount of variance in the construct in question, which is cleared up by its forerunner variables in the model. The R2 quality is acquired because the case estimations of the latent variable are dictated by the weight relations (Chin 1998), and the interpretation is indistinguishable to that of traditional regression. The change in R2 is investigated to see whether the effect of a particular independent latent variable on a dependent latent variable has a generous effect. According to Hair et. al., (2014) the R2 value ranges from 0 to 1 with more elevated amounts indicating larger amounts of predictive accuracy, while R2 values of 0.20 are viewed as high. According to Chin (1998), $R^2$ values for endogenous latent variables are assessed as follows: $R^2$ values of 0.67, 0.33, or 0.19 for endogenous latent variables can, as a rough rule of thumb, be respectively described as substantial, moderate, or weak.In addition, path coefficients range between 0.10 – 0.30 along with measures that explain 50% or more variance is acceptable (Chin, 1998).

**Table 1.3 :** Results of Path coefficient and t-statistic

| Path | Path coefficients | t |
|---|---|---|
| PE → Student's Achievement | 0.103 | 1.525 |
| SE → Student's Achievement | 0.187 | 2.938 |
| SM → Student's Achievement | 0.171 | 2.797 |
| TE → Student's Achievement | 0.274 | 3.980 |
| **$R^2$** for Student's Achievement | 0.402 | |

t-values > 1.96* (p< 0.05)

Table 1.3 indicated that, the path coefficient and t-statistic. In this study, the dependent construct (student's achievement) has an $R^2$ value of 0.402. As a result, the EP, SE, SM, and TE explained 40.2 percent of variance in student's achievement.

***Discussion:***

Overall, the purpose of this study is to identify determinants to the adoption of mathematics homework engagement of students,teachers, parents and school managements towards mathematics achievement. From four hypothesis tested, only three relationships were supported via the effect of student's, teacher's and school management's mathematics homework engagement on mathematics achievement and another relationship via the effect of parent's mathematics homework engagement on mathematics achievement was not supported even the t-value shown it was significant. It is because the hypothesis is positively related, but since the beta value shown was negative, it means that parent's engagement was negatively related to the mathematics achievement.

Findings of this study for student's engagements aligned with Carini *et al*., (2006); Kuh, (2009) and Murugan and Arsaythamby (2015) whose found student's engagement in completing homework lead to higher achievement and have a beneficial effect on the learning outcomes for a long time and the development potential of the students. Outstanding students are students who are more motivated, independent, systematic, and continuous learning (Hong, 2001).

Teacher's mathematics homework engagement revealed a significant positive relationship towards mathematics achievement. This findings was aligned with Murugan and Arsaythamby (2015) and Hammond (2006) whose reported the quality of instruction is highly important and it is in the hand of teachers and the content being taught if they are able to demonstrate their willingness to teach these students with the support of the necessary available resources which is the secondary. The effectiveness

of homework can be improved by providing a choice of homework tasks to students. This directly will result in motivation and higher students performance, student autonomy, and intrinsic motivation (Patall *et al*., 2010). Besides that, mathematical learning is a cognitive and an emotional activity (Else-Quest, Hyde & Hejmadi, 2008), and so a teacher needs consider the academic integrity and the affective consequences when setting homework tasks. Research literature indicates that providing more opportunities for students to respond, it can increase the number of attempts through training that leads to better retention of newly learned knowledge (Cates, 2005). When teachers design homework to meet specific purposes and goals, more students complete their homework and benefit from the results (Epstein & Van Voorhis, 2001). In fact, when homework is properly utilized by teachers, it produces an effect on learning three times as large as the effect of socioeconomic status (Redding, 2000).

Parent's mathematics homework engagement is not significantly relationship towards mathematics achievement. This findings was supported by Balli, Wedman ; Demo, 1997; Cooper *et al*, 2000 ;Epstein, 1988 and Murugan and Arsaythamby (2015). Whereby, this findings aligned with Patall, Cooper, and Robinson (2008) whose reported in a meta-analysis 22 samples from 20 studies correlating parent involvement and achievement reveals positive relationship to primary school but a negative relationship for secondary school students'. Besides that, researchers such as with Cooper *et al*., (2000) have also found that students at higher grade levels received less direct involvement from parents on homework. For example, adolescence is a period of attempts to develop some level of independent and autonomous from their parents in many domains (Gutman & Midgley, 2000). Although parents provide guidelines for doing homework or provide direct assistance for doing homework, but it is an effective form of parental involvement only for elementary school students. Students who reach adolescence, it may be important for parents to gradually withdraw from the process and the involvement of homework and they have to switch to an autonomous form of support students' efforts.

Findings supported that school management's mathematics homework engagement is positively related to mathematics achievement. This finding is aligned with Murugan and Arsaythamby (2015). School management also has the authority to measure and upgrade the necessary recommendations needed to change the system in mathematics if they feel that there is a necessity to do so. They should be held accountable in the curriculum based factors of studies by providing adequate solutions in their success (Bakar, 2007).

According to Chin (1998), $R^2$ values for endogenous latent variables are assessed as follows: $R^2$ values of 0.67, 0.33, or 0.19 for endogenous latent variables can, as a rough rule of thumb, be respectively described as substantial, moderate, or weak.In addition, path coefficients range between 0.10 – 0.30 along with measures that explain 50% or more variance is acceptable (Chin, 1998). In this study, student's engagement and school management engagement revealed $R^2$of weak and teacher's engagement revealed $R^2$ of moderate. As a result, the student's engagement,teacher's engagement, parent's engagement and school management's engagement explained 40.2 percent of variance in student's achievement.

***Conclusion:***

Mathematics homework plays a major role in improving student's mathematics achievement among Malaysian secondary school students. Findings revealed that, student's, teacher's and school management's mathematics homework engagement positively significant with mathematics achievement. Whereby, parent's engagement in mathematics homework is not significant with mathematics achievement. Besides that, , the dependent construct (student's achievement) has an $R^2$ value of 0.402 and showed that the student's engagement, teacher's engagement, parent's engagement and school, management's engagement explained 40.2 percent of variance in student's achievement. Despite only four variables which are investigated, these findings also have important implications and great value to teacher's, school management's, and policy maker.

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