Under-/over-rating of mathematics self-concept and educational outcomes: The roles of ego-dimensions and public self-consciousness

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The present study examines the link between students' under-/over-rating of mathematics self-concept and educational outcomes in mathematics such as achievement and motivation. Also of interest are dimensions of ego-involvement (ego-orientation and competence-valuation) and public self-consciousness as two factors that might contribute to predicting under-/over-rating. It is hypothesised that ego-orientation, competence-valuation, and public self-consciousness are positively associated with over-rating of mathematics self-concept. To examine these issues, high school students responded to a questionnaire that assessed motivation orientation, competence-valuation self-consciousness, maths motivation (future plans for maths), and maths self-concept. Over-rating of self-concept was associated with higher levels of maths motivation and maths achievement at a later time (Time 2). Findings also indicate that ego-orientation and competence-valuation are positively associated with over-rating, whilst public self-consciousness is associated with a tendency to under-rate oneself in maths competence. Task-orientation, whilst not predicting self-appraisals, was negatively associated with Time 2 maths achievement.

Under-/over-rating of competence and educational outcomes

Work in recent years has not only examined the relationship between self-concept and educational outcomes, but also the precise nature of these self-reports such as those which take the form of under- or over-rating of competence. Typically under-/over-rating is determined by matching self-reports of competence with appraisals made about the individual by another person who knows him/her well such as his/her teacher. (Thus the teacher is seen as the 'objective' rater). The discrepancy between the two reports can be used in various ways as the determinant of under-/over-rating.

Moderate over-rating has been related to academic intrinsic motivation, teacher-rated engagement, and constructive coping in the face of failure (Assor & Connell, 1992). Assor and Connell (1992) report a study by Assor, Ilardi, & Lin (1992) which found that positive bias in high school students' self-reports of competence significantly influenced achievement up to two years later. In another study, Connell and Ilardi (1987) compared over-, under-, and congruent-raters on measures of self-esteem, self-regulation, and coping behaviours. Over-raters reported significantly higher self-esteem and less anxiety than under-raters. They were also more motivated than under-raters to
do school work and were more active in responding to perceived failure.

It seems, then, that individuals are capable of forming biased appraisals of their competence and it has been proposed that there is a need for research designed to determine 'the variety of factors that may be responsible for bias in appraisals in general and in self-assessment in particular' (Boekaerts, 1991, p. 14). Indeed, this is a primary focus of the present investigation. Accordingly, the present paper seeks not only to further assess the relationship between over-rating of self-concept on achievement and motivation, but to explore factors that might predict these self-appraisals. It is proposed here that two such factors are dimensions of ego-involvement and public self-consciousness.

Dimensions of ego-involvement

It has been contended that there are four broad dimensions of ego-involvement (Greenwald, 1982; Breckler & Greenwald, 1986). The first form relates to concern about the impression one is making on others and evaluation by them. This is most often elicited when a socially desirable outcome such as intelligence is emphasised in an experimental or task setting. The second form of ego-involvement relates to concern about one's private self-image. In such cases, the evaluation is private wherein the individual attempts to meet standards set by him or herself. The third relates to the personal importance of the task and competence in it (competence-valuation), whilst the fourth relates to concern the individual has about his/her performance relative to that of others (ego-orientation: Nicholls, 1989). The present study focuses on the latter two: competence-valuation and ego-orientation. In apparent contrast to the dimension of ego-involvement is that of task-involvement. Individuals who are task-involved tend to focus on mastery of the task itself and operate in reference to their previous performance and personal standards rather than in reference to performance by others.

In general, ego concerns, relative to task-related concerns have been argued to be maladaptive in educational contexts (Elliot & Dweck, 1988; Graham & Golan, 1991). Some evidence exists, however, that suggests there may be a positive relationship between ego-dimensions and competence appraisals. A study that directly addressed the relationship between ego-involvement and self-concept was conducted by Conway and Howell (1989) who explored positive bias in the recall of self-referent words under ego-involving or non ego-involving conditions. They found that ego-involved individuals recalled significantly more positive self-referent words than non ego-involved individuals. Conway and Howell (1989) argued that ego-involvement accesses a positive self-schema which may be due to (a) impression
management in the face of a threat to the self-concept (Singer & Salovey, 1988) or (b) a sense of challenge that activated positive cognitive information (Smith & Ellsworth, 1985). Likewise, in an earlier study, Covington and Omelich (1978, cited in Covington, 1992) explored self-appraisals of ability following ego-involving feedback about performance relative to others on a previously administered test. Their results suggested that study participants were more likely to provide reports about their ability that were inflated relative to appraisals they made about confederates in the study. In relation to ego-orientation, Duda and Nicholls (1992) found that this dimension correlated more highly with perceived ability than task-orientation.

It seems, then, that ego-involvement in the forms of ego-orientation and competence-valuation could be hypothesised to be dimensions that can influence self-reports of perceived competence such that it is positively related to inflated reports of self-concept. It might therefore be conjectured that ego-orientation and competence-valuation could be associated with perceived competence not only in the form of over-rating of self-concept. A factor to now be addressed that is hypothesised to operate in a similar way is public self-consciousness.

Public self-consciousness

It has been proposed that self-consciousness (see Duval & Wicklund, 1972 for formulations on self-focus theory) takes two forms: private and public (Buss, 1980). Private self-consciousness refers to the dispositional tendency to direct attention internally from one's own perspective, whilst public self-consciousness refers to the tendency to attend to oneself from an external perspective.

Public self-consciousness, the self-consciousness dimension of particular interest in the present study, refers to the individual's tendency to think about him/herself as a social object. Individuals high in public self-consciousness tend to be more aware of aspects of the social self and concerned about the impression that they are making on others. Such individuals typically do not turn attention inwards and thus, according to the theory, are less likely to engage in discrepancy reduction, report accurately, or inhibit impression-management tendencies. It is suggested that individuals high on this trait appear more likely to be concerned with managing the impressions they make on others. Following from this, it is contended that public self-consciousness is associated with self-presentation generally and with positive bias in particular (Turner & Peterson, 1977; Willerman, Turner, & Peterson, 1976).

Given that public self-consciousness is related to self-presentation, it could be predicted that these individuals, when interacting with others, will attempt to present as favourable an image as possible.
Indeed, Reno and Kenny (1992) found that this was the case. In their study, individuals high in public self-consciousness (as measured by the revised Self Consciousness Scale - SCS-R) were more likely than individuals low on the trait to attempt to impress a stranger in a social interaction. Furthermore, public self-consciousness was more positively correlated with self-ratings of conveyance, openness, trustworthiness, and likeability than private self-consciousness.

The evidence, then, does suggest that individuals who focus on themselves as social objects (publicly self-conscious) are also more likely to engage in self-presentational behaviour. Given this it is inferred that students in the present study who are high in public self-consciousness will self-present such that they will tend to over-rate their self-concept.

Thus far this paper has attempted to draw together areas of educational, personality, and social psychology in a way that predictions can be made about the nature of self-relevant beliefs and important educational outcomes such as motivation and achievement. It is broadly contended that ego-dimensions in the forms of ego-orientation and competence-valuation and public self-consciousness are related to self-reports of self-concept which in turn predict achievement and motivation. In particular it is hypothesised that (a) over-rating of maths self-concept is positively associated with motivation and achievement in maths, (b) public self-consciousness will be associated with over-rating of maths self-concept, and (c) ego-orientation and competence-valuation are also positively associated with over-rating.

METHOD

Subjects

Respondents were 382 Year 9 (41% boys and 59% girls) and Year 11 (49% boys and 51% girls) students drawn from two (School 1, n=187; School 2, n=195) non-government high schools in Sydney's outer western suburbs. Mean age of the Year 9 group was 14 years 6 months and of the Year 11 group, 16 years 6 months.

Materials

Students were administered a questionnaire that contained items measuring ego- and task-orientation (Motivational Orientation Scale: Nicholls, 1989), private and public self-consciousness (Revised Self Consciousness Scale: Scheier & Carver, 1985), maths self-concept (Self Description Questionnaire II: Marsh 1990b), maths-motivation (Skaalvik & Rankin, 1995), and maths competence-valuation (single item), as well as demographic characteristics such as age and gender. Ego-orientation (e.g., `I feel really successful in schoolwork when I know more than
other people') measures the extent to which individuals are motivated to outperform others. Task-orientation (e.g., 'I feel really successful in schoolwork when I solve a problem by working hard') is a measure of the extent to which an individual is motivated to master his or her schoolwork. Public self-consciousness (e.g., 'I care a lot about how I present myself to others') is a dimension that explores the extent to which an individual is concerned about how he or she is evaluated by and appears to others. The maths subscale of the SDQ II (e.g., 'Mathematics is one of my best subjects') explores an individual's perceptions of his or her ability and liking for mathematics. Maths motivation (e.g., 'In the future I would like to learn more mathematics') is reflected in the individual's willingness to pursue mathematics in the future. Competence-valuation is a single item ('It's important to me to do well in mathematics classes') designed to assess the extent to which doing well in the subject is important to the individual. Aside from the demographic items, items on all the subscales were responded to on 5-point (ego- and task-orientation), 4-point (private and public self-consciousness), and 6-point (maths subscales) Likert-type rating scales, consistent with use of the scales in previous research. After reversal of appropriate items, high scores on items reflected more agreement to the respective item and subscale referents.

To collect data that would provide information as to students' tendency to under-/over-rate, teachers were asked to respond to a questionnaire containing four (positively worded) randomly selected items from the maths SDQ II subscale that was to be completed for each student in the class. The items were to be responded to using the same 6-point Likert-type scale (False [1] to True [6]) used in the student questionnaire. To each of the four items, teachers were asked to "rate how each student should have responded if they were to have answered accurately and realistically". Teachers were asked to provide "should" ratings based on how the student "compared to other students in this class". Teachers were also asked to report the mathematics result each student had gained during the previous term's (Term 3) examination period. At the end of that year (end of Term 4) teachers reported the maths result gained for the end-of-year maths exam. Thus, two maths exam results were included in the final analyses: Time 1 and Time 2. Correlation between teacher ratings and Time 1 exam results was .71.

Given that respondents made ratings based on factors unique to their class, maths-related subscale scores were converted to standardised scores (M=0, SD=1) within each class. In this way, comparisons between classes could be made and the sample be examined in unity. The ego-/task-orientation and private/public self-consciousness subscales were retained as unstandardised subscale means.

Identifying groups of under-, congruent-, and over-raters

A tripartite split on the student- and teacher-rated competence scores
was performed and in this way we were able to identify groups of low, moderate, and high self- and teacher-rated students. We then examined the teacher-rated medium self-concept group for all three levels of student rated competence (see Assor, Tzelgov, Thien, Ilardi, & Connell, 1990 for a review of the advantages of this method). So, for the teacher-rated medium self-concept group, students who rated themselves as low in self-concept can be said to be under-raters; students who rated their competence as moderate are congruent-raters; and students who rated themselves as high in competence can be said to be over-raters. Focus is upon the group that is comprised of under-, congruent-, and over-raters - that is, the teacher-rated medium self-concept group. Thus, the teacher is seen as something of an 'objective' rating.

RESULTS

Preliminary analyses

For each of the scales, principal axis factoring with varimax rotation were performed. Results of this operation are summarised in Table 1. Ego- and task-orientation items loaded clearly on their hypothesised factors, as did future plans for maths and maths enjoyment items. Results of the SDQ II factor analysis suggested a three-factor structure: maths, physical, and combined academic and general. The SCS-R factor analysed acceptably with the exception of one private self-consciousness item which was excluded from later analyses.

Table 1. Summary of final factor analytic results

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<td>Ego</td>
<td>.68</td>
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<td>24.0</td>
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<td>Task</td>
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<tr>
<td>Future plans</td>
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<td>29.5</td>
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<tr>
<td>Enjoyment</td>
<td>.68</td>
<td>.28</td>
<td>26.7</td>
<td>.86</td>
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<td>Maths</td>
<td>.61</td>
<td>.15</td>
<td>12.1</td>
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<td>Physical</td>
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<td>12.6</td>
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<td>Acadc &amp; Genl</td>
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<td>22.3</td>
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<tr>
<td>Private*</td>
<td>.48</td>
<td>.15</td>
<td>14.3</td>
<td>.75</td>
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<tr>
<td>Public</td>
<td>.67</td>
<td>.12</td>
<td>18.6</td>
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* one item removed

Correlations between key variables

Correlations between variables for the entire sample are presented in Table 2. Ego-orientation and competence-valuation were correlated only to a small and non-significant degree. Ego-orientation and public self-consciousness were also only slightly correlated. Ego-orientation
was correlated with maths self-concept to a limited extent. Competence-valuation was significantly correlated with maths self-concept and future plans. Task-orientation was, to a limited (but significant) extent, positively related to students' maths self-concept. Public self-consciousness was not significantly correlated with reports of self-concept nor was it related to future plans for maths. Time 1 maths achievement correlated significantly with maths self-concept and teacher ratings of students' self-concept. Students' self-concept was significantly and positively correlated with teachers' ratings.

Table 2. Correlation matrix of key variables

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<td>2. Public.</td>
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<td>3. Task</td>
<td>0.29*</td>
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<td>4. Ego</td>
<td>0.06</td>
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<td>5. Comp val.</td>
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<td>6. Mth slf-cpt.</td>
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<td>7. Tcher ratg.</td>
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<td>0.23*</td>
<td>0.53*</td>
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<td>8. Time 1 exam</td>
<td>0.05</td>
<td>0.03</td>
<td>0.09</td>
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<td>0.71*</td>
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<td>9. Time 2 exam</td>
<td>-0.04</td>
<td>-0.04</td>
<td>0.03</td>
<td>0.18</td>
<td>0.34*</td>
<td>0.46*</td>
<td>0.52*</td>
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<td>10. Fute plns</td>
<td>-0.07</td>
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<td>0.27*</td>
<td>0.16</td>
<td>0.21</td>
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*p<0.05 after Bonferroni correction

Factors predicting under-/over-rating and educational outcomes

The group that encapsulates under- congruent-, and over-raters is the group rated by the teacher as moderate in competence. As is displayed in Figure 1, consistent with hypotheses, the over-raters in this group outperformed congruent and under-raters.

Figure 1. Time 2 exam performance for students rated by their teacher as moderate in self-concept

The model central to hypotheses in the present study was one that examined the role of under-/over-rating in predicting educational outcomes and factors that might predict this under-/over-rating. As noted above, this involved analysing the self-concept of the group of students rated by their teacher as moderate in self-concept. To do this, data were analysed with path analysis using EQS (Bentler, 1993). EQS is a statistical program that tests the fit between a sample covariance matrix and an hypothesised matrix. Relationships between observed variables are represented by paths with single-headed arrows
and correlations are represented by double-headed arrows between independent variables. Error variances are also provided for each dependent variable in the model. Paths are reported as standardised coefficients that would result if other variables in the model were held constant. A fit index for the model is also provided. The present model used the comparative fit index - CFI (Bentler, 1990), which has the advantage of reflecting fit at diverse sample sizes (Bentler, 1993). Maximum likelihood was the method of estimation used in the model.

All student variables and paths central to hypotheses were first tried in the model. The raw data were used as input to EQS which subsequently analysed the covariance matrix. The model was modified and additional paths were tested to improve the fit of the data to the hypothesised model. This also involved dropping some variables and paths from the analysis.

Insert Figure 2 about here

The final model providing the best fit appears in Figure 2. No special problems or out of bounds parameter estimates were encountered. The model fit the data well ($c^2=23.8, df=21, CFI=.98$) and converged in 7 iterations. Because all data relate to students rated as moderate in actual competence, higher scores on maths self-concept are postulated to be indicative of over-rating of one's competence, whilst lower scores are indicative of a tendency to under-rate one's competence.

The major finding was that over-rating of one's competence is associated with higher levels of educational performance. Interestingly for this group, performance at Time 1 does not substantially predict exam performance at Time 2 (however, note that Time 1 exam scores are probably attenuated due to selection of only the medium self-concept group). It does, however, operate via maths self-concept to predict Time 2 performance. A number of factors predicted under-/over-rating of maths self-concept, the strongest being public self-consciousness. However, counter to hypotheses, higher levels of public self-consciousness were associated with under-rating of maths competence. Higher ego-orientation and competence-valuation were associated with over-rating of maths self-concept, however, the former two did not directly predict performance at Time 2. Task-orientation negatively predicted exam performance at Time 2 and future plans for mathematics. Also, willingness to pursue maths in the future was positively predicted by over-rating of one's maths self-concept, and high competence-valuation.

DISCUSSION

The present study sought to investigate the effect of
under-/over-rating of maths self-concept on mathematics achievement and future plans for motivation (argued to be a component of motivation) as well as to identify factors that might predict these self-appraisals. Over-rating was hypothesised to positively predict achievement and motivation and factors that were predicted to influence these self-appraisals were self-consciousness and ego-involvement. Specifically, public self-consciousness was hypothesised to be associated with positive bias in self-reports in the form of over-rating of self-concept and ego-dimensions in the forms of ego-orientation and competence-valuation were also hypothesised to yield similar positive bias in self-reports of self-concept.

Consistent with hypotheses, over-rating of self-concept was positively associated with a student's reported willingness to pursue maths in the future. Results in the present study also suggested, consistent with hypotheses, that over-rating was associated with higher achievement at a later time. These results are consistent with a large body of research that reports a correlation between perceived competence and achievement in educational contexts and a smaller body demonstrating the positive effects of over-rating of one's competence. Concerning the latter, results uphold Assor and Connell's (1992) contention that self-reports of competence are valid self-appraisals even if they do not match with 'objective reality' that take the form of teacher ratings.

It may be that congruent or accurate perceptions of self-relevant dimensions such as self-concept have the effect of binding the student to existing notions of self and previous performance. Optimism may have the effect of releasing the student from these constraining forces in such a way that optimistic students can realise a potential to which they would otherwise not aspire. It also shows that students who conceive of their competence beyond that of the teacher's conception are in a stronger position to achieve at a later time. This optimism may be an arousing or energising force that enhances motivation and evokes a generativity and confidence of action that increases the likelihood of meeting with later success.

It was hypothesised that public self-consciousness would evoke self-presentational tendencies thereby motivating the individual to over-rate him/herself. In the present study, however, the opposite was the case: Publicly self-conscious individuals were more likely to report a lower self-concept and under-rate themselves. Sansone (1986) had earlier argued that concern with evaluation by others may be an aversive state and thus too great a threat to the ego. In relation to the present study, public self-consciousness was hypothesised to be a measure of the dispositional tendency to be concerned about how others viewed the individual. In the Sansone (1986) study, concern about evaluation by others tended to impair performance, and, by implication,
could be expected to do the same for competence beliefs.

Another explanation for the public self-consciousness findings can be found in cognitive-evaluation theory (Deci & Ryan, 1987; Ryan & Deci, 1989) and its relation to self-consciousness (Plant & Ryan, 1985). It could be argued that private self-consciousness is associated with internally controlled behaviour whereas public self-consciousness is more related to externally controlled behaviour (Plant & Ryan, 1985). This being the case, Plant and Ryan (1985) suggested that public self-consciousness could be associated with decreased levels of intrinsic motivation and subsequent performance - an effect typically found with individuals whose behaviour is externally controlled. Similarly, it could be suggested that perceptions of externally controlled behaviour (in the form of public self-consciousness) would lead to some sense of helplessness and this cannot be expected to impact positively on self-concept (see Abramson, Seligman, & Teasdale, 1978).

In the present study, competitive interests (ego-orientation) were found to be associated with over-rating of self-concept. While this is inconsistent with findings by Nicholls, Cheung, Lauer, & Patashnick (1989), who found no relationship between ego-orientation and perceptions of competence, it is consistent with a later paper (Duda & Nicholls, 1992) which reported a moderate positive correlation between the two. In another study, Sansone (1986) found that feedback about performance relative to others led to increased motivation (see also Harackiewicz & Manderlink, 1984; Harackiewicz et al, 1985) and it is argued (and found) here that it may ultimately have the same effect on self-concept. Moreover, it is interesting to note that whilst ego-orientation has been previously found to be maladaptive relative to task-orientation (Elliot & Dweck, 1988; Graham & Golan, 1991), the present results show no role for task-orientation across the entire sample and a weak positive one for ego-orientation.

As hypothesised, ego-orientation was also found to positively predict over-rating. Ego-orientation elicits concern about one's performance relative to others and in this sense prompts a competitive concern. This could be hypothesised to be arousing and evoke some degree of optimism and thereby activate more positive self-referent cognitions (Smith & Ellsworth, 1985). Also, given that individuals who are ego-oriented are more likely to experience ego-threat within the classroom and be concerned with maintaining their sense of ability (Covington, 1984, 1992), they could be expected to report a positive self-concept (Singer & Salovey, 1988). This was confirmed in the present study.

These findings support other research which has found that competitive or achievement interests can be adaptive. Giannini, Weinberg, and Jackson (1988) reported that ego-orientation enhanced performance in a sporting environment whilst a number of studies by Biggs and colleagues
have found that achievement/competition-oriented interests lead to higher levels of reported self-concept and/or educational performance (Biggs, 1987; Renshaw & Volet, 1995; Watkins & Hattie, 1992). It is proposed that in the present study, ego-orientation is a dispositional trait that motivates the individual to protect his/her sense of ability by engaging in more positive self-reports of competence which ultimately enhanced performance at a later time.

Consistent with hypotheses, the ego-dimension, competence-valuation, was a relatively strong predictor of maths self-concept and over-rating. Consistent with Meece et al (1990), competence/task-valuation also predicted future plans for maths and Time 2 achievement via maths self-concept. Thus, the importance an individual places on doing well in maths does impact positively on perceptions of competence as well as affect other important educational outcomes such as motivation (see also Harackiewicz et al, 1985). It is further suggested that individuals who value competence in an area are also motivated to protect their sense of ability in that domain. An obvious way of doing this would be to self-report in a way that does not reflect a potentially underlying sense of lower ability. The present study found this to be the case in that competence-valuation positively predicted self-concept and over-rating.

To conclude, then, the present study further clarifies the role of perceived competence and educational outcomes as well as identify factors that might predict these appraisals of competence. Consistent with previous work, over-rating positively predicted achievement and motivation. Counter to some previous work, ego concerns were found to positively impact upon self-appraisals of competence and/or achievement.

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