LONGITUDINAL CURRICULUM DESIGN for piano skills’ teaching and learning

(with the THINKING ROOT from QUANTITATIVE ANALYSIS and EDUCATIONAL METROLOGY)

Word Count: 3284 (excluding the reference and title)

Title:
The exploration of the SPSS longitudinal quantitative data-sets through a transcendental research-proposal of the design-based pedagogical quasi-experiment-model of piano-skills

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Constructing one grand tutorial-based pedagogical methodology (mixed) of piano skills through the longitudinal quantitative analysis:

Research Background and self-reflexivity:

There is a social phenomenon: with the improvement of Chinese people’s living standards, piano formal and informal tutorial-based pedagogy in China is increasingly popular in ordinary people’s life. Based on it, the professionalization of the formal and informal pedagogical researching and praxis of piano-skills has gained the increasing attentions of musicians, tutors, parents, children and young people. (Waterhouse, 2010; Gouzouasisa & Ryua, 2014; Partti, 2014; Xiong, 2007). There is another self-reflexivity case as one projection of this trend: developing my tutor – Ms. Wang’s piano-training methodology, my mother and I have also been teaching and studying in this field for around ten years informally with many good students succeed in taking the Chinese grading test and the entrance exam of musical college.

The root of longitudinal researching model:

In China, there is a gap between theoretical strategies and practical teachings in piano-performing. CRs (Critical Realists) have stated: ‘the complex social events and phenomena usually contend multiple causes, so that we can build a theoretical model to understand its properties and forces.’ and ‘the hierarchical things, of which if we re-order and re-classify the sub-properties and relations, we can motivate the mechanism to produce new powers (functions)’ (Archer, 1995; Edwards, 2014). By the analysis above, ‘Post-transcendental tasks-based quasi-experiment’ is a good model for this research.
Explanation: ‘Tasks-based’, stated by Weiss (2005) as ‘Time series’, is to use the control of
time stage by stage to systematically train the skills and motivate innovatively understanding
of the musical themes. Another term - ‘Quasi-experiment’ gave the possibilities to control the
conditions and test the possible casual effects, meanwhile, ‘Quasi’ enlarges the exploration to
a wide scope of the correlations or covariation. Then, ‘Post-transcendental’ stands for: If any
post-theoretical model can be constructed by describing the pre-processing unfolding of the
universal regulations, it will be of effectiveness to guide the praxis (Gribbin, 2004; Finseth,
2014).

The research model-hypothesis:

By shifting the deductive theories from root into the field of training piano skills, 6 basic
properties can be abstracted: rhythm-feeling, ears-training, notes-recognizing & sight-reading,
comprehensive skills-learning, formal performing, and musical themes & beliefs-exploring in
terms of one core longitudinal variable - tutorial time-line, which can also be compared with
the 6 life stages of knowledge accepters in the natural growth of human beings (Bultu D. Bultu
F., 2012; Kupana a*, Otacioglug 2012; Santos & Hentschke, 2011; Waterhouse, 2010).

Explanation of the longitudinal analysis as the ‘time series’
paradigm of this model:

By summarizing the statements of ‘Longitudinal analysis’ from various disciplines in the book
<Modelling longitudinal data’ made> by Weiss (2005), the definition, characteristics of
longitudinal analysis can be found:

1. **Longitudinal data analysis**: Longitudinal analysis is originally from transcendentalist
nature science with the sequencing experimental series. As Davies (1994) reveals that
the definition of it should be: For a period, the observer usually has been tracing the
multiple physical, psychological, pedagogical traits etc. of individual as one moving
mechanism alongside the growth of age for long time such as weekly recording one
person’s weights for a couple of years, then summarizing the key standards of findings and analysing (Weiss, 2005, pp. 2-3; Creaven, 2000; Callinicos, 2006).

2. ‘Time series data’ has the ‘time order’: another characteristic is that the emergence of multiple-dimensions stages (levels) have a unified time-line inside and being logically threaded together. My research model also has the time-line simulating the stages of the transcendental unfolding of human being’s life-span cognitive growth, such as the periods ‘from conception to birth…’, ‘Piaget’s periods of cognitive development’, ‘Vygotsky’s sociocultural theory’, Erikson’s 8 stages and linguistic unfolding theory including Chomsky’s transformational generative grammar etc. (Kosslyn, 2004 pp.482 - 531; Robert E. Owens, 2001, pp. 67-107). 6 different stages can be constructed, which the later one will take the former as the integrated part into its own structure:

1) **Rhythm-feeling:** This training simulates the first period of life - From conception to birth – of which the information acceptor is the rhythm system. The operation: putting the rhythm-feeling about 5 – 10 minutes in front of the course would be an effective choice to piano pedagogy.

2) **Ears – training:** though in the uterus, foetus has been developing the function of auditory system (Hepper and Shahidullah, 1994). However, it isn’t real auditory system but rhythm through eardrum and skin. From the a couple of hours of birth that eyes can’t work and only ears till 1 year old, the visual system has just been being totally unfolded and the auditory organ is the main tendency of infant’s cognitive acceptor. Identifying our empirical teaching accumulation, the time of this training should be 5 -10 minutes.

3) **Sight-reading and comprehensive skills-learning:** The research from Kupana and Otacioglub (2012) revealed that sight-reading is also the foundation of carefully learning comprehensive abilities of piano. Adolescence, compared with comprehensive skills’ learning, has some similarities which needs us ‘getting it all together’ and making the
application of the new knowledge gained in mind for enlarging our world (Kosslyn & Rosenberg, 2004, pp.523).

The time of sight-reading in one designed session should be 5 to 10 minutes. The main training of the comprehensive abilities should be 30 minutes.

4) **Formal performing**: This stage in the logic-time-line can be compared with the age of middle adulthood, which involves the application of all the abilities mentioned before but also includes a higher learning zone of getting the senses of achievement. It is another kind of musical recreation, which takes 5 minutes.

5) **Musical theme & beliefs exploring**: it is an innovative stage compared with the last life-stage – old period in Erikson’s life-span theory that you should construct your philosophical system and beliefs (Kosslyn and Rosenberg, 2004). This process usually takes 10 – 15 minutes as a conclusion and abstraction of students’ learning.

**SPSS data-sets from piano-teaching model for the quantitative analysis:**

In this section, I will make a 60 minutes design-based teaching and learning model of piano skills including 6-sections into data-sets:

**Explanations of how to use the piano-pedagogic materials as the researching measure-scale by SPSS:**

The works of Carl Czerny in China are of great popularity for piano learning and teaching, of whose works - 599, 849, 299, 740, 718 etc., each piano piece can be seen as the training scale from the simplest to the most professional level covering students in different ages.
Take an example, as the picture shown below:

These two bars are referenced from Czerny (699, piece 12, 1957). How can we use it to calculate the right actions, afterwards, putted into SPSS?

**The operations of basic quantitative statistics towards this piece of collected material:**

1. In ‘Sight-reading’: If the person has beaten all the 41 notes, he will get the score 8.2; Meanwhile, if he matches the dotted quarter note with 12 demisemiquavers right twice, the person will get 9.2. Finally, if the person can play the middle part by the minim alongside the first part, the person can get the full score 10.0. After this measurement, sight-reading can be put into SPSS as the continuous (number) variable;

2. The same method of calculating quantitative data from the scores can also be shifted into the rhythm-feeling, ears-training, comprehensive skills’ training and formal performing stages;

3. **Theme & beliefs-exploring**: this is a half-opened creative thinking training session that teachers need to give an overall evaluation of students’ performance through dialogue by measuring thoughts with one classified mind-mapping-scale.
1st option: Multiple linear-regressions combining AONVA test alongside the time:

1. When this paper comes here, one framework of this grand theoretical model about 60 minutes will be made out and shown above in the flowing chart.

   In this case, in order to explain this teaching & learning model of piano skills from both dynamic and static perspectives, we need to choose 3 different pictures to see it:

   1) Static quantitative analysis – traditional Multiple Linear Regression (MLR):
   
   If we take a picture of the interior of this model and see several piano-performing abilities as a relatively static situation. In another words, each ability is relatively independent without being influenced by time. We can see MLR as a questionnaire or pre-testing of one quasi-experiment. The function of this option can help us investigate the piano-level informally or formally – by implementing the ideas of multiple-factors analysis and the multiple-intelligences. Afterwards, the practical steps can be concluded as below:

   I. Collecting the 6 types of data about the sampled 30 students and putting them into the data view of SPSS:
The symbols of each variable will be: the overall integrative ability of piano performance is represented by the symbol ‘\( y \)’. \( x_1 \) stands for Rhythm-feeling. And so forth, \( x_2 \rightarrow \) Hearing-training, \( x_3 \rightarrow \) sight-reading, \( x_4 \rightarrow \) comprehensive skills – learning, \( x_5 \rightarrow \) formal performing, \( x_6 \rightarrow \) Themes & belief – exploring:

The statistics model which reveals the relationships between the dependent variable \( y \) and the 6 independent variables which are together form the multiple liner regressions equation:

\[
y = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + b_6 x_6
\]

**Explanation:**

\( b_0 \) is the accumulation of the piano abilities gotten before this tutorial from nature or learnt with other teacher;

\( b_1 \text{ – } b_6 \) are the partial regression coefficients. In this case, the function of them reveals that if we make a hypothesis that: in the stage of n, without the consideration of the changes of other piano abilities, the dependent piano ability - \( x_n (0 < n \leq 6) \) has \( b_n \% \) possibility to cause the change of the overall integrative ability of piano performance - \( y \);

\( y \) is the dependent variable which summarizes and concludes all the multiple-abilities from different aspects. Meanwhile, it is also one interval variable, which can be made the plus, subtraction operations.

II. Calculating all the rates \( b_1,b_2,b_3,b_4,b_5 \) and \( b_6 \) (SPSS can help us conveniently and fast take this step by putting several buttons):

A. Through the Analysis of variance (ANOVA), my hypothesis that there are multiple-liner regressions between the group of independent variables and the dependent variable. If Sig. is between 0.000 and 0.05, we can reject the \( H_0 \) that there is no linear regressive relationships existing between them.
B. The table of coefficients with T values - test reveals the reliability of the coefficients and show whether or not the influence from the sub-abilities towards the overall ability is significant or not.

III. Finally, predicting the situation of this theoretical model and its predicted distribution about 30 people: Minimum, Maximum, Mean and Std. Deviation can tell us the situation of each statistics value – such as the predicted value, Std. Residual and Std. Predicted value etc.

2nd option: Longitudinal data-sets analysis about ‘time’:

4. After frequently tested, the overall time arrangement should be fixed as shown:
   Rhythm-feeling → 3 minutes, ears-training → 6 minutes, sight-reading → 12 minutes, comprehensive skills - learning → 30 minutes, formal performing → 3 minutes, Themes & belief - exploring → 6 minutes

5. About recoding ‘time’ variable: ‘Time’ is a very complicated variable for coding that you can recognize it as ordinal (different stages), interval or continuous variable. The handing methods of ‘time’ reflected the metacognitive strategies of devising your research. In this case, There were 3 methods to record the ‘Time’ variable:

1) In China, the tutorial time is usually 1 hour for students in different ages. It is a common knowledge that ‘time’ is coded by sexagesimal system. However, in this case, we need to recode it into decimal system. How can we do it?

The equation can help us:

\[
Tp = \left[ \left( \frac{Tm}{60} \right) \times 100 + \frac{Ts}{60} \right] \times \frac{100}{100} \\
(0 < Tp < 1, 0 < Tm < 60, 0 < Ts < 60)
\]

Explanation:
Symbols:

‘Ts’ stand for how many seconds during timing the students’ preforming;
‘Tm’ stands for how many minutes are counted in the timing process
‘Tp’ stands for: comparing with the whole time period of student’s tutorial, how much percentage, he (or she) has finished.

Operations:

It is a common habit that when at one certain time you want to know the situation of student, you usually record the time point, the score (or what has happened). If we want to know the certain time point (23m. 21s) during your timing how much percentage of this tutorial session your student has completed, we need to input the counting numbers into this equation: \( Tp = \left( \frac{23}{60} \times 100 + \frac{21}{60} \right) = 38.68333\% \).

After this operation, the counted ‘Time’ variable can be quantitative analysed and calculated as the continuous variable.

2) Recoding the continuous variable - ‘Time’ into ordinal variable: you need to click the button ‘Recode’ in the ‘Transform’ of the menu items –list; then, you need to:

Recoding ‘0~0.05’ as ‘rhythm feeling’, ‘0.05~ 0.15’ as ‘Hearing-training’, ‘0.15~0.35’ as ‘Sight-reading’, ‘0.35~0.85’ as ‘Comprehensive skills-learning’, ‘0.85~0.90’ as ‘Formal performing’, ‘0.90 ~1’ as ‘Musical themes & beliefs exploring’. Then, this variable can be used as one continuous (interval) variable and be calculated with other variables such as making the correlations, Multiple Liner Regressions, ANOVA as one core independent variable in the multiple analysis of variances.

3) ‘Week’ variable: ‘longitudinal methodology of quantitative analysis’ needs the observers accumulate the data every tutorial weekly by repeatedly participate-observing the students’ improvement for long time. Further dynamic or static researches can be done based on this emergent accumulation.
Taking the independent variable ‘time’ into the designed teaching & learning model:

The nature of time is chaos. Thus, the lengths of the 6-periods longitudinal piano-teaching methodology is also from chaos, which can be recognized as both the continuous variable – timing from seconds to minutes and the ordinal variable – different stages. Thus, synthetically applying these two types of ‘Time’ variables into two system - one is the ‘continuous time’ in the objective world, another is the subjective empirical ‘time zones’ - can help us make much deep senses of the situation of the contradictorily moving classroom alongside time.

After the theoretical analysis above, currently, we come to the practical issues with the supports of SPSS:

Firstly, the self-made statistics equation combining the actual operations of SPSS software, after a large review of longitudinal data analysis in the books of different subjects can be constructed as shown below:

\[
y = \sum_{1}^{n} \left[ (T_p - \sum_{1}^{n-1} Z_{t(n-1)}) \frac{x_n}{1 - \sum_{1}^{n-1} Z_{t(n-1)}} \right] + b
\]

\[
0 \leq y - b \leq 60; \quad 0 \leq x_n \leq 10
\]

\[
1 \leq n \leq 6
\]

\[
Z_{t(1-1)} = 0 \quad Z_{t(2-1)} = 0.05
\]

\[
Z_{t(3-1)} = 0.15 \quad Z_{t(4-1)} = 0.35
\]

\[
Z_{t(5-1)} = 0.85 \quad Z_{t(6-1)} = 0.90
\]

\[
n = \frac{T_p}{Z_t} \text{ (Recoded in SPSS)}
\]
Practical and applicative explanation of these equations for this model with the supports of the software – SPSS:

The explanations of the Symbols:

1. \( y \) is the overall longitudinal ability summarized by adding and handling all the independent variables together from \( x_1 \rightarrow \) ‘rhythm-feeling’ to \( x_n \rightarrow \) ‘in one certain stage, the ability (score) is’.

2. \( n \) is the serial number of the stage after recoding the continuous ‘Time’ variable into ‘ordinal’. \( n = \frac{T_p}{Z_t} \). In this equation, \( T_p \) is the continuous ‘Timing’ ratio which means the length students have taken part compared with the whole tutorial time – 1 hour. Meanwhile, \( Z_t \) stands for the time-length of each stage of the ordinal timing unit. Here, I want to emphasise that the partition of every improvement zone is uneven from the subjective empirical teaching accumulation and understandings.

3. \( b \) stands for the overall ability gotten in the past or through the analysis of the Multiple linear regressions and AONVA. When the student firstly come to take the tutorial organized by the piano teacher, \( 'b' \) can be gained by applying MLR as the abilities - test and flexibly applying each section and the whole 1 hour as a scale for teacher to grist the situation of student.

The explanation of the main equation and the correlations with others:

We can make a combination of the two options. Following the pre-test (1st option) of associating one student evaluate his piano-performing level by using multiple linear regressions and AONVA, the following formal tutorial will begin. If the teacher want to ‘make a picture’ of one certain timing point that what situation the individual student’s ability is and how much learning zone of ability he (she) makes since he take
the tutorial, Tutor just need to calculate them together by following the equation step by step.

The former equation helps us transform the time of sexagesimal system into the completed ratio in decimal system. Then it will be recorded into ordinal variable. In another words, ‘n’ will be counted standing for what stage she is in. Following it, the dynamic independent variable $x_1$ to $x_n$ will be added up, each of which is counted as a score between 0 and 10 and will be gotten through every task in the 6 stages. The handling method is shown in the part of the introduction of using the works of Carl Czerny. The overall piano ability – ‘y’ will be counted by adding the score of every stage together. Therefore, it should be $0 \leq y - b \leq 60$. Through the interactional calculation of the two different timing ways – ordinal and continuous variables, the flexibly ever-varying slop will be confirmed when the time point is given through the equation. Then, the increasing part of the piano performing ability –zoon on the timing point will be gained. By repeatedly adding the results of ability-zoon from the time when $n = 1$ to the final one – $n$, the different dimensions of 6 different abilities have been reduced into one core dimension – time liner and added together. Finally, the overall ability will be gotten through adding the past (overall) ability – ‘b’ with the outcomes of this piano-tutorial together.

The question comes out that: how we can get the slope of the certain timing point by interacting the different timing methods together and meanwhile calculating them:
The answer is by the participate-observation and reasonably thinking:
Currently, we all know that $T_p$ is a continuous variable of ‘Time’ which has been recorded into 6 objectively unequalled but subjectively equalled stage-units.
Based on the tutor and researchers’ habits that they usually code the time and score on the coding sheet, if we can just know what time and what score (ability) the students have gotten on that point, then depending on their past ability and our calculation, we can simply find what is his (or her) improvement in this session and what is the overall ability. It will be beneficial for teacher to organize the class, understand students’ problem and associate students make a plan for further development.
By analysing the participate-observed y value when $T_p$ stays in different divided-time-zones:
0 < \( T_p \leq 0.05 \), \( n = 1 \), \( y = b + T_p x_1 \);

0.05 < \( T_p \leq 0.15 \), \( n = 2 \), \( y = b + T_p x_1 + \frac{T_p - 0.05}{1 - 0.05} x_2 \);

0.15 < \( T_p \leq 0.35 \), \( n = 3 \), \( y = b + T_p x_1 + \frac{T_p - 0.05}{1 - 0.05} x_2 + \frac{T_p - 0.15}{1 - 0.15} x_3 \);

\[ y = b + \sum_{1}^{n} \left[ (T_p - \sum_{1}^{n-1} Z_{(n-1)}) \times \frac{x_n}{1 - \sum_{1}^{n-1} Z_{(n-1)}} \right] \]

\[ 0 \leq y - b \leq 60; \ 0 \leq x_n \leq 10 \]

\[ 1 \leq n \leq 6 \]

Furthermore, the enlightenments as a conclusion:

In praxis, the story is going on to the practical part of reasonably solving the limits and bridging the gaps for further improvement:

1. When facing the longitudinal data with time by participate-observation of the students’ situation, the teachers as the researchers must frequently observe the changes of the collected data of SPSS and take a dynamical, hierarchical and sustainable outlook of students’ development;
2. In this design-based post-transcendentalist quasi-experimental grand model of teaching & learning piano skills, every task-based stage can be distinguished as a dynamic training alongside the time’s going on. It can also be used as a static investigation of analysing the correlations and co-variations between different sub-abilities;

3. The design of ‘Week N, Week N+1 …’ is another method to extend longitudinal data under a much wider statistics and discussion for longer time;

Limitations:

4. The complexity of grasping the main tendency in the contradiction limits the functions of applying this model. Therefore, it gives the higher requirements to the piano-tutors to update the teaching experiences, self-organize and self-make the teaching materials and gain rich teaching skills to flexibly deal with all sorts and levels of students;

5. Time, to me, is limited. It just allows me to present the research proposal covering the careful design and metacognitive strategies of making this reasonably theoretical model. Further researches is running on with the supports from a series of practical schools will be done according to this design in the future.
Reference:


Available at: [http://dx.doi.org/10.1080/14613808.2014.972924](http://dx.doi.org/10.1080/14613808.2014.972924) (Accessed: 12 July 2015)


