

# Exploration Ethnomatematics in Musical Instruments Gordang Nine with Theory Geometry Two Dimensions and Three Dimensions

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**Abstract.** Draft mathematics used for explore existence mathematics in culture especially in art, one of which is in tools music gondang part time. one culture mandailing is *Gordang Part time* that is tool music traditionally composed from nine drums with different heights and diameters so that produce different tones and played by 5-6 players. Research this aim for knowing how history and concept mathematics contained in the musical instrument *Gordang While*. Obtained data form data qualitative whereas data source obtained from observation, documentation and related interview with godang musical instrument part time. Instrument in study this is guidelines interview, sheet observation, and documentation. Type study this is study qualitative character descriptive. Research results show that *godang* musical instrument *Part time* this born range 600 AD in the kingdom Sibuar Connection. Nine drums of *Gordang Part time* have names different names on each area, consists of the 9 types of drums that have different sizes. Every size have 5 cm difference in each the drum. *Gordang Part time* have 1 type form geometry get up flat that is form circles on the top and bottom from tube *Gordang Part time* and 2 types form geometry get up room that is tube and cone beheaded.

**Keywords:** Ethnomatematics , Gordang while , Geometry two dimensions and three dimensions

## I. INTRODUCTION

Indonesia is known with various countries variety culture nor tradition from sabang until marauke the culture that is owned is very enchanting. Indonesia consists from 34 provinces spread throughout island , within there is more of 740 tribes nation / ethnicity . Every area no same so that can become Indonesia's capital for ammo expansion culture ( education local ) but that happened is culture local Indonesia Keep going eroded by globalization without there is strategy preservation culture . ( Indriani, S. 2018).

Culture and society is two mutual elements attached , because there is mutual relationship Among culture with society , as there is connection Among culture , civilization and history . Society can produce culture , meanwhile culture that determine pattern from Public that alone . So between humans and culture is something unit that has very close relationship .

Planting cultural values can be done through the family environment, education, and in the community environment, of course. Culture describes the characteristics of a nation and Indonesia is a rich country of culture. Cultural practices allow the embedding of mathematical concepts and recognize that everyone develops a special way of doing things mathematical activity called ethnomatematics. Ethnomatematics includes ideas mathematics, thought and practice developed by all cultures. The goal of ethnomatematics is to recognize that there are ways different ways of doing mathematics by considering knowledge academic mathematics developed by various sectors of society as well as taking into account different modes where different cultures discuss their math practice (how to classify, count, measuring, designing buildings or tools, playing and others). Ethnomatematics raises cultural wisdom so that it is able to motivate student in learning mathematics.

one part from education provided at school is education math . Development knowledge knowledge and technology no escape from role mathematics inside . Mathematics needed for needs practical and solving problem in life everyday . For example , can count , got count content and weight , can collect , process , present and interpret data. Society can produce culture , meanwhile culture that

determine pattern from Public that alone. So between humans and culture is something unit that has very close relationship.

Mathematics is universal subject in which each culture have draft numbers and ideas that  $1+1=2$ , no care how advanced existing culture and technology. Idea universal math more reinforced by facts that that created around the world. Mathematics that terjub because exists activity human “ *Mathematics as human activities*”. ( Tandililing, P. 2012.38). When culture mathematics and education combined, mixing this often named with ethnomathematics . Wahyuni (2015) defines that ethnomathematics is ways specifically used by a group culture or Public certain in activity math . Where is activity mathematics is activity that's in it abstraction process takes place from experience real in life daily to in mathematics or otherwise, includes activity grouping, counting, measuring, designing building or tools, create pattern, count, determine location, game, explain, and so on. From before until moment this eye lesson mathematics still considered tough lesson , even many thinking students mathematics as scary study. this is something must question quick answered by the candidates educator math , with look for solutions new , for one is use ethnomathematics .

*Gordang Part time* is inheritance culture original owned by Public Mandailing Natal, North Sumatra. Instrument this is tool music traditional which is not there is second to none in culture Indonesian nation.

*Gordang Part time* is nine each drum have size different which is symbol nine figure in structural society . in accordance with function and level. The characters these, respectively symbolized with one fruit size magnitude in accordance with level and function figure the in society . As for the order gonggang from the biggest to the smallest and nine figure functionaries Public the is ; (1) *Gordang Part time* the biggest is symbol for King Panusunan Feather , degree for a best king ever build a number of village . the king chosen by character Public from several kings who led villages in Mandailing ; (2) One gonggang is symbol from Datu that is servant important a king for To do communication with natural magical or spirit ancestor ; (3) Natorasyang is a representative data ; (4) King Pamusuk is leader predominant custom one village ; (5) one gonggang for Head Ripe , namely the representative of King Pamusuk ; (6) Ulan that is one who represents mora ie someone from from party family wife ; (7) Talaga that is a representative child boring that is relatives who took wife ; (8) one gonggang represent Ulubalang that is Security security village ; (9) Suruonkonon is servant from the king. (Majid, A, 2013).



Figure 1. Musical instruments Gordang Part time

Destination study this to find out how the history and mathematical concepts contained in the *Gordang Sembilan* musical instrument related Theory geometry two dimensions and three dimensions , so that the Indonesian people know that no only just tool music course , but *Gordang While* also having draft math .

## II. METHODS

Type study this is qualitative descriptive with use study field or environment natural as direct data source .. Time of research is ever study this going on , start from planning until with drafting report study Study this done at home leader *Art Pakantan Mountain Kulabu* Mr. Ridwan Aman Nasution . Study this have three subject namely : 1). Mr. Ridwan Aman Nasution as the first subject (N1), 2). Mr. Ardiansyah Nasution as subject second (N2), 3). Mr. Mulyadi Lubis as subject third (N3). Instrument his research is guidelines interview , sheet observation and

documentation and researchers use tool data collection consisting from : 1). Guidelines interview , 2). Cellphone, 3). Book writing and tools write , 4). Camera for documentation . Data collection techniques are carried out with 3 methods namely : 1). Interview , 2). Observation , 3). Documentation . Researcher will To do Interview with S1, S2, and S3, meanwhile Observation and Documentation only done at home Leader Art Pakantan Mountain Kulabu Mr. Ridwan Aman Nasution (S1). Obtained data from interview , observation , and documentation will analyzed data with a number of step namely : 1). Data collection , 2). Data verification , 3). Data interpretation , 4). Make conclusion . Data validity technique is Triangulation with source , that is with compare and check ( test ) back degrees trust something informant for obtain data validity from a number of valid source . it could achieved with Street compare result data observation with yield data interview .

### III. RESULTS AND DISCUSSION

#### The History of Gordang Sambilan

From the results Interview researcher with N1, N2, and that N3 history *Gordang Part time* known before Islam has function for ceremony call spirit grandmother ancestor if needed his help. Ceremony the named *Paturuan Sibaso* which means call spirit for possessing / *possessing the Sibaso* medium. Destination calling this is for ask for help spirit grandmother ancestor for resolve moderate difficulty override society . For example moderate illness epidemic because exists something transmission attacking disease an area. On the side that gonggang part time used for ceremony ask rain ( *Mangido Udan* ) for rain down so that could resolve annoying dryness activity agriculture. Also aim for stop rain that has going on in a manner Keep going continuously already raises damage. ( Nasution Sakinah, 2012).

#### Same Gordang Size

*Gordang Part time* this have different shapes and sizes and produce different sound too . Shape and size this is what there is in *Gordang Part time* have meaning and can also relate with ecological , because that *Gordang Part time* proper Becomes inheritance culture ancestor Mandailing Christmas. Exploration results ethnomathematics on tools music *Gordang Part time* this is known form physique *Gordang Part time* there is two type form geometry part room that is shaped tube and cone beheaded . *Gordang part time* also have size which different also, the smallest drum (drum 1) is striped middle 20 cm, the 2nd drum is striped 25 cm in the middle , the 3rd drum is striped middle 30 cm later with so on the more big the difference in the middle line is 5 cm to the biggest striped the middle 60 cm is the 9th drum. About size drum height as well as dariyang smallest about 120cm up highest 160 cm.

Midline size high line resulted happening variation similar sound more not enough like difference in scale . On the side difference size above , the difference sound too could generated with tightness pull rope rattan which tied up on membrane drum skin. ( Sofia Indrani lubis , 2018).

#### Draft Geometry Two Dimensions And Three Dimensions On Gordang Part time

Exploration results ethnomathematics on tools music gonggang part time is known that form physique Gordang Part time there is two type form geometry get up room that is shaped tube and cone beheaded.

#### Geometry Two Dimensions

After conducted exploration of the *Gordang* musical instrument *Part time* that form top base *Gordang Part time* shaped a circle . Circle is one Geometry two dimensions.



Figure 6. Circle Gordang Part time

## Geometry Three Dimensions Tube Gordang Part time

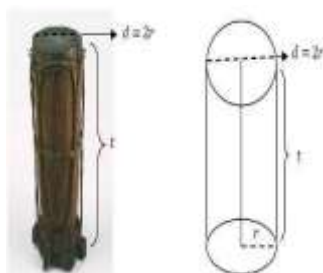


Figure 7. Tube Gordang Part time

Gordang Part time as tube it means large the sides of the plinth and roof are identical . Form Gordang Part time resemble room three dimensions tube .

Next , done measurement circumference of base/roof, area blanket , and the volume of the tube Gordang While . Calculation results tube Gordang Part time could shown in Table 1 below this :

Table 1. Results Measurement Tube Gordang Part time

Gordang Part time	Gorgeous height (cm)	Diameter (cm)	Fingers (cm)	Around (cm)	L. Blanket (cm <sup>2</sup> )	Volume (cm <sup>3</sup> )
1	120	20	10	62	7,440	37,714
2	125	25	12.5	78	9,750	61,383
3	130	30	15	94	12,220	91,928
4	135	35	17.5	110	14,850	129,937
5	140	40	20	126	17,640	176,000
6	145	45	22.5	141	20,445	230,705
7	150	50	25	157	23,550	294,642
8	155	55	27.5	173	26,815	368,401
9	160	60	30	189	30,240	452,571

### a. Cone beheaded Gordang Part time

Form *Gordang Part time* resemble cone beheaded that is cone cut by a field parallel with pedestal field . *Gordang Part time* called with Cone beheaded because have different sizes of plinth and roof . So that our name with Cone beheaded *Gordang While* . Measurement results direct obtained that *Gordang Part time* have diameter on from gondang smallest until biggest each 20, 25, 30, 35, 40, 45, 50, 55, 60 cm and base diameters 17, 22, 27, 32, 37, 42, 47, 52, 57 cm. Figure 8. shows illustration Cone beheaded *Gordang Part time*

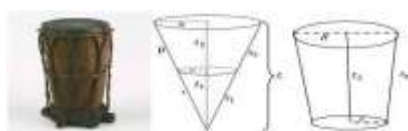


Figure 8. Cone beheaded Gordang Part time

Next , done calculation of volume and area blanket cone beheaded Gordang Which one before has conducted measurement direct to roof diameter and diameter pedestal as well as tall from cone longest Gordang While . Summary results calculation shown in Table 7 below this :

Table 7. Results Measurement and Calculation Cone beheaded Gordang Part time

Gordang part time	(cm)	d roof (cm)	R(cm)	d pede stal (cm)	r (cm)	K pede stal (cm)	S(cm)	L (cm <sup>2</sup> )	V (cm <sup>3</sup> )
1	120	20	10	17	8,5	62	121	7,035	32,339
2	125	25	12.5	22	11	78	126	9,306	54,312
3	130	30	15	27	13.5	94	131	11,734	83.0442
4	135	35	17.5	32	16	100	136	14,319	119,111
5	140	40	20	37	18.5	116	141	17,182	163,134
6	145	45	22.5	42	21	132	146	20,097	215,660
7	150	50	25	47	23.5	147	152	23,169	277,313
8	155	55	27.5	52	26	163	157	26,398	348,670
9	160	60	30	57	28.5	179	162	29,785	430,322

### Discussion

Musical instrument Gordang Part time as one culture mandailing can be applied in learning mathematics that is with see form Gordang Simultaneous resemblance tube and cone beheaded . This could made tool for introduce concepts mathematics like draft geometry so that in understand draft natural mathematics abstract student could with easy understand it . Besides that is , exploration about the diameter (diameter ) of the roof, diameter of the base, radius top , base radius , circumference up , around top , broad circle , area surface cylinder , cylinder volume , area surface cone truncated and the volume of the cone beheaded too done . Where are the sizes of the 9th Gordang Part time form line arithmetic . With explore culture as a medium in learning expected student could more easy understand learning , too grow attitude love will culture as well as conserve culture through learning at school .

### IV. CONCLUSIONS

Tool music Gordang Part time this is tool which shaped drum big which consists from 9 fruit drum and everything each different size from the smallest until biggest . Musical instrument Gordang Part time this already born since 600 AD in area mandailing so start from pre-islamic tool music this already exist and their functions also vary . Gordang Part time is one culture typical The famous Mandailing Natal until with now . Draft math on musical instruments Gordang Part time seen from perspective ethnomathematics could found in Musical Instruments Gordang Part time that is Geometry dimensions Two and Dimensions Three , shapes from Gordang While in shape base Circles , Tubes and Cones beheaded .

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